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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **3282**

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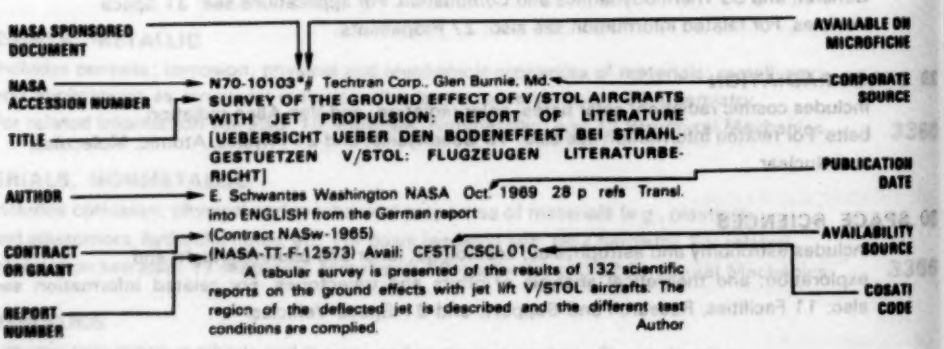
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A tabular survey is presented of the results of 132 scientific reports on the ground effects with jet lift V/STOL aircrafts. The region of the deflected jet is described and the different test conditions are complied.
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VOLUME 8 NUMBER 18 / SEPTEMBER 23, 1970

Scientific and Technical Aerospace Reports

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N70-33426# National Research Council of Canada, Ottawa (Ontario).

DETERMINATION OF THE BUFFET BOUNDARIES OF AIRCRAFT WINGS IN THE TRANSONIC VELOCITY REGIME [DIE ERMITTLUNG DER SCHUETTELGRENZEN VON TRAGFLUEGELN IM TRANSSONISCHEN GESCHWINDIGKEITSBEREICH]

Fred Thomas 1970 43 p refs Transl. into ENGLISH from Jahrb. der WGLR (West Germany), 1966 p 126–144
(NRC-TT-1408) Avail: CFSTI

A method based on boundary layer theory is described by which the buffet boundaries may be calculated without empirical criteria. The transonic pressure distribution with compression shock is determined. Using laminar and turbulent compressible boundary layer calculation, the corresponding separation points are determined from the transonic velocity distributions. The onset of buffeting and the effect of Reynolds number on the position of the buffet boundaries are discussed. Good agreement was found between the theoretical results and those from wind tunnel and flight tests. N.E.N.

N70-33634# Naval Weapons Lab., Dahlgren, Va. Warfare Analysis Lab.

THE EFFECT OF FIN SLOTS AND FIN TABS ON THE DYNAMIC STABILITY CHARACTERISTICS OF THE NAVY LOW DRAG BOMB

Peter Daniels 7 May 1970 23 p refs
(AD-705986; NWL-TR-2403) Avail: CFSTI CSCL 19/2

The report presents the results of a research program to improve the dynamic stability characteristics of the Navys Mk 81 Low Drag Bomb by introducing fin slots and roll tabs. Wind tunnel tests and flight tests were conducted to prove the design. It appears that fin slots and roll tabs are a promising fix for stabilizing the bomb. However, more drops with larger initial release disturbances must be conducted before this result can be considered conclusive. Author (TAB)

N70-33671# Lincoln Lab., Mass. Inst. of Tech., Lexington.

SIMPLE ESTIMATES OF WAKE VELOCITY PARAMETERS

Edward M. Hofstetter 23 Apr. 1970 16 p refs
(Contract AF 19(628)-5167)
(AD-705590; TN-1970-11; ESD-TR-70-90) Avail: CFSTI CSCL 16/3

A technique for using a sequence of two-pulse bursts for obtaining estimates of mean wake velocity and wake velocity width was proposed. The derivation of this technique was based on heuristic reasoning. The report derives the same estimates from the theory of maximum likelihood estimation. Author (TAB)

N70-33808*# Translation Consultants, Ltd., Arlington, Va.

WALL EFFECT ON A HELICOPTER ROTOR IN A CLOSED CIRCULAR TUNNEL: INCOMPRESSIBLE FLOW AROUND A DOUBLET PLACED IN A CLOSED CIRCULAR TUNNEL [EFFET DE PAROI SUR UN ROTOR D'HELICOPTERE EN VEINE FERMEE DE SECTION CIRCULAIRE: ECOULEMENT INCOMPRESSIBLE AUTOUR D'UN DOUBLET PLACE DANS UNE VEINE FERMEE CIRCULAIRE]

P. Michel Washington NASA Jul. 1970 98 p refs Transl. into ENGLISH from French report
(Contract NASw-2038)
(NASA-TT-F-13155) Avail: CFSTI CSCL 20D

A method of calculating the interaction of a cylindrical wall with a circular straight section with the flow from a doublet placed in any way in this wall is described. This method is designed to be used in testing helicopter rotors. Included are descriptions of conditions to be satisfied by complementary potential, calculation principle of complementary potential, development of Fourier series for function, calculations of complementary potential and velocities induced by doublet D. Annexes contain descriptions of Euler, hypergeometric Gauss and modified Bessel functions, as well as reference citations. Author

N70-34003*# Dynatech Corp., Cambridge, Mass.

ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF HIGH ENTRAINMENT JET PUMPS

Kenneth E. Hickman, Gerald B. Gilbert, and John H. Carey Washington NASA Jul. 1970 215 p refs
(Contract NAS2-4824)
(NASA-CR-1602) Avail: CFSTI CSCL 20D

In this investigation, a simple analytical model was developed to predict the performance of high-entrainment compressible flow jet pumps with constant area mixing tubes. While the model is suitable for hand calculation, a computer program was prepared to facilitate calculation of jet pump performance curves and allow comparison of different jet pump designs. Analytical techniques were developed for matching the jet pump design to its associated duct system in order to achieve maximum entrainment or thrust augmentation. The validity of the analytical model was confirmed by an extensive test program using a multiple-nozzle jet pump with two different mixing tube lengths. The primary-to-secondary flow area ratios were varied from 0.0013 to 0.0067. The primary flow pressure ranged from 55 psia to 350 psia and the primary flow temperature ranged from 200 F to 1200 F. The observed entrainment ratios varied from 15 to 37. The performance of each jet pump geometry was measured over a very broad range of operating conditions in order to develop performance maps for comparison with the analytical predictions. Author

N70-34016*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVERSE-METHOD SOLUTION FOR RADIATING, NONADIABATIC, EQUILIBRIUM INVISCID FLOW OVER A BLUNT BODY
Ralph A. Falanga and Edward M. Sullivan Washington Aug. 1970 35 p refs
(NASA-TN-D-5907; L-7209) Avail: CFSTI CSCL 20D

An inverse flow-field program capable of making calculations with an equilibrium air gas model and a realistic radiation model has been developed. The program is capable of calculating the inviscid flow field on a blunt body over a large range of conditions. The primary restrictions are that the assumed shock be analytic in shape and that the postshock temperature be between 10,000 K and 15,000 K. Comparisons are presented which show substantial agreement between the results from the present program, results from a direct-method program, and results from a time-asymptotic-method program for a nonadiabatic flow field. The inverse method can be operated with 8 to 24 rays and 5, 7, 9, or 11 radiative-flux calculations along each ray. A brief study has shown that a nominal set of 14 rays and 9 radiative flux calculations will produce accurate results over the entire range of applicability of the program. Author

N70-34048*# National Aeronautics and Space Administration, Washington, D.C.
IMPULSE OF FORCES AND MOMENTS EXPERIENCED BY A SLENDER WING IN UNSTEADY FLOW [OB IMPULSE SIL I MOMENTOV SOOBSHCHAEMYKH TONKOMU KRYLU PRI NESTATSIONARNOM OBTEKANII]
A. I. Golubinskii Aug. 1970 6 p Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 6, Nov.–Dec. 1968 p 114–117
(NASA-TT-F-13066) Avail: CFSTI CSCL 20D

An analysis is presented showing that the lifting force and the moments acting on a slender wing of finite span and arbitrary planform moving at a constant mean velocity in gas can be determined from the quasi-stationary theory which assumes that at any moment of time, the flow is steady and that the steady values of the flow parameters are equal to their instantaneous values. This result is obtained on the basis of certain implications which are derived from the flow reversibility theorem. Author

N70-34073*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF ANGLE OF ATTACK AND BLUNTNESS ON THE HYPERSONIC FLOW OVER A 15 DEG SEMIAPEX CONE IN HELIUM
Joseph W. Cleary and Charles E. Duller Washington Aug. 1970 43 p refs
(NASA-TN-D-5903; A-3566) Avail: CFSTI CSCL 20D

Effects of angle of attack and bluntness on the hypersonic flow over a 15 deg semiapex cone were experimentally investigated for the limiting specific-heat ratio 1.67. Results are presented from wind tunnel tests in helium at a free-stream Mach number of 14.9 and Reynolds number based on base radius of 860,000. Included are measurements of surface pressure and heat transfer coefficients, shadowgraphs of shock-wave shape, and limiting streamlines adjacent to the surface. The tests spanned angles of attack from 0 deg to 30 deg and cone-bluntness ratios from 0 to 0.4. Comparisons of measurements with theory indicate generally good agreement. Author

N70-34090*# Translation Consultants, Ltd., Arlington, Va.
CALCULATION BY AN INTEGRAL METHOD OF THE LAMINAR BOUNDARY LAYERS UNDER THE EFFECT OF AN ENTROPY GRADIENT [CALCUL PAR UNE METHODE INTEGRALE DES COUCHES LIMITES LAMINAIRES SOUS L'EFFET D'UN GRADIENT D'ENTROPIE]
G. Kretzschmar Washington NASA Aug. 1970 27 p refs Transl. into ENGLISH from Rech. Aerospatiale (Paris), no. 133, Nov.–Dec. 1969 p 15–27
(Contract NASw-2038)
(NASA-TT-F-13147) Avail: CFSTI CSCL 20D

The laminar boundary layer in hypersonic flow is calculated by an integral method. The method indicates the effects of the entropy gradient existing within the external flow, and also of the induced pressure gradient due to the displacement effect. The method is illustrated by some special applications. The main difficulties encountered are the necessity of assessing the physical thickness of the boundary layer, and also the accuracy to which the shape of the detached shock wave must be known. Author

N70-34182*# Translation Consultants, Ltd., Arlington, Va.
THE PROBLEM OF OSCILLATIONS OF A THIN PROFILE IN A SUBSONIC FLOW NEAR A RIGID BOUNDARY [K ZADACHE O KOLEBANIYAKH TONKOGO PROFILYA V DOZVUKOVOM POTOKE VBLIZI TVERDOY GRANITSY]
I. I. Yefremov Washington NASA May 1970 6 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 7, 1969 p 119–121
(Contract NASw-2038)
(NASA-TT-F-12966) Avail: CFSTI CSCL 20D

Subsonic flow calculations over a thin profile with chord length 2c moving with small harmonic oscillations with frequency omega near a rigid boundary are revised. Author

N70-34200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN PROGRAM FOR CALCULATING AXIAL TURBOMACHINERY BLADE COORDINATES
Theodore Katsanis Washington Aug. 1970 24 p refs
(NASA-TM-X-2061; E-5662) Avail: CFSTI CSCL 20D

A FORTRAN 4 computer program has been written to calculate blade coordinates with respect to the true blade chord. The required input is the axial blade chord, blade stagger, leading- and trailing-edge radii, angles of tangency on leading- and trailing-edge radii, and a few intermediate spline points. This input is identical to the geometrical input required for blade-to-blade aerodynamic analysis programs. Author

N70-34259# Oceanics, Inc., Plainview, N.Y.
THE AERODYNAMIC CHARACTERISTICS OF A SLENDER BODY TRAVELING CHOKED IN A TUBE
Theodore R. Goodman Jan. 1970 112 p refs
(Contract DOT-FR-9-0020)
(PB-190395; TR-69-67) Avail: CFSTI CSCL 13F

In order that a tube vehicle system (TVS) be economically feasible it is necessary that the vehicle fill the tube as much as possible because tunneling costs are very high. Under these circumstances the body-tube ratio may be so large that the flow in the annular passageway between the body and the tube will choke. The paper is concerned with analyzing the flow and determining the aerodynamic forces acting on a vehicle under these circumstances. When the flow is choked a shock wave appears downstream of the throat and the flow never expands to upstream ambient conditions. This unsymmetrical flow situation creates a wave drag and increases the lift and moment substantially above the values they have in subcritical flow. Author (USGRDR)

N70-34290# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
LEADING EDGE SEPARATION ON AN AIRFOIL DURING DYNAMIC STALL
Stephen A. Patay Oct. 1969 56 p refs
(Contract N00019-68-C-0081)
(AD-701771; ASRL-TR-156-1) Avail: CFSTI CSCL 1/3

To obtain a better understanding of the leading edge separation

mechanism on a wing pitching upward with a constant angular velocity, an unsteady boundary layer calculation is performed. The analysis considers a potential flow about a Joukowsky airfoil, which then forms a basis for the boundary layer calculations. An integral technique which is similar to the Karman-Pohlhausen method is used to determine the viscous flow. The movement of the separation point is calculated for several pitching rates. A comparison with some experimental data was made for both the static and dynamic case. It was determined that the point of boundary layer separation coincides with the formation of a separation bubble for the dynamic cases considered. Author (TAB)

N70-34291# Notre Dame Univ., Ind. Coll. of Engineering.
A STUDY OF THE TURBULENT NON-NEWTONIAN BOUNDARY LAYER ON A FLAT PLATE
R. L. Sampson and A. H. P. Skelland Dec. 1969 83 p refs
(Contract N00014-68-A-0152; Proj. Themis)
(AD-701770; THEMIS-UND-69-10) Avail: CFSTI CSCL 20/4

A summary of the design study conducted for construction of a water tunnel and instrumentation system suitable for investigations of turbulent non-Newtonian flat plate boundary layers is presented. The tunnel characteristics are evaluated and data obtained with a laser-velocimeter is compared to that generated with pitot tubes. A theoretical correlation between drag coefficients and appropriately defined non-Newtonian Reynolds numbers is developed in a manner analogous to a Newtonian analysis by Prandtl. Velocity profiles measured by laser velocimeter for power law turbulent boundary layer were obtained and used to determine drag coefficients which were compared with theoretical predictions. Reasonably good correlation was obtained. Author (TAB)

N70-34299*# Techtran Corp., Glen Burnie, Md.
GENERAL METHOD FOR DETERMINING THE OPTIMAL TURBINE PARAMETERS WITH LOW VOLUME FLOW [OBSHCHIY METOD OPREDELENIYA OPTIMALNYKH PARAMETROV TURBIN S MALYM OBEMNYM RASKHODOM]
O. N. Yemin et al Washington NASA May 1970 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), no. 1, 1969 p 70–76
(Contract NASw-2037)
(NASA-TT-F-12980) Avail: CFSTI CSCL 20D

General analytical relations that correlate the optimal turbine parameters and analyze the effect of turbine parameters on the choice of the optimum dimensions are determined. Problems based on the generalization of data concerning the vane height, partiality, and flow angle effects on the turbine efficiency is proposed. The solution is found for active subsonic and supersonic turbines used for driving auxiliary systems. Author

N70-34312*# Techtran Corp., Glen Burnie, Md.
INDIRECT METHOD OF DETERMINING AIR FLOW THROUGH INSIDE CHANNEL AND GAS TEMPERATURE IN FRONT OF DOUBLE FLOW TURBINE [KOSVENNYY METOD OPREDELENIYA RASKHODA VOZDUKHA CHEREZ VNUTRENNIY KONTUR I TEMPERATURY GAZA PERED TURBONOY DVUKHKONTURNOGO DVIGATELYA]
N. V. Pervyshin et al Washington NASA 9 p Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), no. 1, 1969 p 93–98
(Contract NASw-2037)
(NASA-TT-F-12982) Avail: CFSTI CSCL 20D

An indirect method is presented for determining the air flow through the inner channel of a double flow turbojet engine and for measuring the gas temperature in front of the turbine on the basis of measurements of temperature and pressure behind the high-pressure compressor and fuel flow through the engine; this method possesses universality. The method can also be used for determining the air flow and temperature for turbojet (single flow) engines in which the first stage of the turbine operates at the critical pressure drop. Author

N70-34314*# Techtran Corp., Glen Burnie, Md.
DISTRIBUTION OF TURBULENT FLOW ON FLAT PERPENDICULAR OBSTRUCTION [RASTEKANIYE TURBULENTNOY STRUI PO PLOSKOY PERPENDIKULYARNO RASPOLOZHENNOY PREGRADE]
E. A. Bulanov et al Washington NASA 8 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), No. 1, 1969 p 115–118
(Contract NASw-2037)
(NASA-TT-F-12984) Avail: CFSTI CSCL 20D

Experimental investigations are described which show that during the spreading of subsonic and supersonic turbulent air flows, there is similarity in the distribution of the velocity thrust, excess stagnation temperature and excess static pressure on the surface of the obstacle. The distribution of these values with respect to a dimensionless coordinate at various distances from the section of the jet obeys empirical laws that are common to the various flows. Author

N70-34350*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
JET-PLUME-INDUCED FLOW SEPARATION ON AXISYMMETRIC BODIES AT MACH NUMBERS OF 3.00, 4.50, AND 6.00
Robert J. Mc Ghee Washington Aug. 1970 39 p refs
(NASA-TM-X-2059; L-7000) Avail: CFSTI CSCL 20D

Some effects of jet-plume-induced flow separation were investigated at free-stream Mach numbers of 3.00, 4.50, and 6.00 on several axisymmetric bodies with various forebody and afterbody geometries. The investigation showed that increasing the jet-pressure ratio resulted in boundary layer separation over large regions of the test models at free-stream Mach numbers of 4.50 and 6.00. Only small amounts of flow separation occurred at a free-stream Mach number of 3.00 for which the test-pressure ratios were considerably smaller than those for the higher Mach numbers. The separation angle measured at an angle of attack of 0 deg showed a primary dependency on jet-pressure ratio and was a weak function of model geometry. The separation length measured along the model surfaces was a function of both jet-pressure ratio and model geometry. Increasing the angle of attack resulted in decreases in both separation angle and separation length on the windward surface of the models. This result may be partially due to local Reynolds number changes, which cause changes in the type of separation. The local-surface-pressure coefficients in the separated-flow region compared reasonably well with the theoretical inviscid values for a cone at high jet-pressure ratios. Author

N70-34532*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF NEWTONIAN STATIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF BODIES OF REVOLUTION WITH VARIOUS HEAT-SHIELD CURVATURES, AFTERBODY ANGLES, AND CORNER-EDGE RADII
Edward A. Mayo and Thomas L. Blakemore 28 Jun. 1961 37 p /*ts* Program Apollo Working Paper No. 1021
(NASA-TM-X-64332) Avail: CFSTI CSCL 20D

Newtonian aerodynamic coefficients are presented for preliminary prediction of the static stability characteristics of bluff reentry bodies with various heat-shield curvatures, afterbody angles, and corner-edge radii. An example of the usefulness of these design curves is presented in the appendix where the aerodynamics characteristics are computed for several configurations of equal volume. Author

N70-34533*# Bell Aerospace Co., Buffalo, N.Y.
THE EFFECT OF EXHAUST CONDITIONS, SURFACE WINDS, AND GEOMETRIC SCALE ON HOT GAS INGESTION FOR TWO JET VTOL CONFIGURATIONS
Patrick E. Ryan and Wayne J. Cosgrove 1969 114 p refs
(Contract NAS1-9584)
(NASA-CR-66965) Avail: CFSTI CSCL 01C

The main objective of this program was to determine whether there was an effect of geometric model scale on the inlet temperature rise caused by recirculating hot exhaust gases from VTOL lift jet engines in static proximity to ground. The approach used was to conduct small-scale tests in which ITR was measured over a range of exhaust pressure ratio, exhaust gas temperature and surface wind velocity for two configurations of a jet VTOL fighter-type model containing four lift jets and comparing the results with large-scale data of similar configurations. The small-scale tests provided a range of simulated inlet and exhaust conditions which included those typical of full-scale turbojet engines. Author

N70-34693*# Techtran Corp., Glen Burnie, Md.
METHOD OF ESTIMATING AERODYNAMIC PROPERTIES OF AN AIRFOIL WITH A HINGED FLAP AND SPOILER [O NACHINU ODREDJIVANJA AERODINAMICHKIKH SVOJSTAVA AEROPROFILA S OBORENIM ZAKRILTSEM I SPOJLEROM]
S. Pivko Washington NASA Aug. 1970 14 p refs Transl. into ENGLISH from Srpska Akad. Nauka i Umetnosti, Glas. Odelenje Tekhnichkikh Nauka, v. 7, no. 266, 1966 p 53 - 63
(Contract NASw-2037)
(NASA-TT-F-13131) Avail: CFSTI CSCL 20D

A method of estimating the aerodynamic properties of a thin airplane wing with a hinged flap and a spoiler is presented. The method is based on previous studies given in the bibliography. Approximate formulas deal with the effects of the hinged flap and spoiler on the air flow around the wing. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-33636# Naval Civil Engineering Lab., Port Hueneme, Calif.
TIRE-PAVEMENT FRICTION COEFFICIENTS Technical Report, Jul. 1967 - Nov. 1968
Hisao Tomita Apr. 1970 107 p refs
(AD-705987; NCEL-TR-672) Avail: CFSTI CSCL 1/5

An investigation consisting mainly of a literature review and a review of current research done outside NCEL was conducted to determine the methods needed to provide safe, skid-resistant surfaces on Navy and Marine Corps airfield pavements. Much of the information reported herein serves to update the information contained in NCEL Technical Report R-303 (AD-602 930). For example, new information is included on friction-measuring methods, correlation of the measuring methods, factors affecting friction coefficients, minimum requirements for skid resistance, and methods of improving the skid resistance of slippery pavements. However, some new topics which are of recent interest are also discussed in detail. These topics include hydroplaning, the mechanism of rubber friction, the friction associated with various operating modes of aircraft tires, the relationship of friction coefficients to pavement surface texture and to surface drainage of water, and the effects of pavement grooving on hydroplaning and on friction coefficients. All the information from the investigation is summarized, and recommendations are given for research and development efforts needed to provide safe, skid-resistant surfaces for airfield pavements. Author (TAB)

N70-33670# Massachusetts Univ., Amherst. School of Engineering.
DUCTED PROPELLERS: A REVIEW AND DESCRIPTION OF CURRENT INVESTIGATION
Ronald J. Weetman and Duane E. Cromack Jan. 1970 78 p refs
(Contract N00014-68-A-0146; Proj. Themis)
(AD-705524; THEMIS-UM-70-1) Avail: CFSTI CSCL 1/3

The paper describes the past theoretical and experimental work on ducted propellers. Also included is a discussion of the limitations of these past investigations. Since the ducted propeller is used parimarily for low speed applications (i.e., deep sea submersibles, tugboats and VTOLs) the theoretical and experimental development for low speed and static conditions is obviously needed. A description of the current and proposed theoretical and experimental investigation for these conditions is presented. Author (TAB)

N70-33694# Air Force Flight Test Center, Edwards AFB, Calif.
PERFORMANCE Final Report
Feb. 1970 432 p refs
(AD-705584; FTC-TIH-70-1001) Avail: CFSTI CSCL 1/3

Contents: The atmosphere; Aerodynamics introduction; Subsonic aerodynamics; Supersonic aerodynamics; Hypersonic aerodynamics; Pitot-static system; Non-steady state performance; Steady state performance; Turning performance; Takeoff and Landing; Fuel flow corrections; Calibration tests; Climb tests; Cruise performance tests; Turning performance tests; and Takeoff and landing performance tests. TAB

N70-33798# National Aviation Facilities Experimental Center, Atlantic City, N.J.
FIRE TEST CRITERIA FOR RECORDERS Final Report
Thomas Rust, Jr. and Paul N. Boris Jul. 1970 44 p refs
(FAA-NA-70-25; FAA-DS-70-16) Avail: CFSTI

Tests were conducted to investigate fire test criteria as applied to flight data and cockpit voice recorder systems and material. Studies were made to determine the effect of elevated temperature on various types of recording tapes and highly conspicuous exterior coatings which could be applied to recorder covers. Open flaming and enclosed furnace tests were performed on complete recording units in order to obtain data for formulating improved standardized laboratory test methods suitable for evaluating survivability of flight data and cockpit voice recorders in a crash-fire environment. Author

N70-33880# Federal Aviation Administration, Washington, D.C.
A SUGGESTED ACTION PROGRAM FOR THE RELIEF OF AIRFIELD CONGESTION AT SELECTED AIRPORTS. SUPPLEMENT
L. N. Million, E. Aikman, J. M. Copeland, and W. C. Keepers 19 Feb. 1970 111 p
(AD-702777) Avail: CFSTI CSCL 1/5

The report separately identifies and analyzes the possible improvements needed to prevent or reduce aircraft delays at ten high density airports with pending congestion problems. The original report dated April 1969 provided analysis for eighteen of the nation's highest density airports which were experiencing serious congestion. Discussion is presented on the causes contributing to aeronautical congestion and on the current operational status of each airport. The supplemental report is concerned primarily with physical construction projects which will enhance the particular airports airfield capacity such as high-speed exit taxiways, parallel

runways, and navigational aids. It also examines certain procedural improvements such as intersection takeoffs and part-time use of taxiways as VFR runways. Each airport improvement, where possible, has been evaluated from a cost vs. delay benefit savings viewpoint. The result is a series of recommended actions for each surveyed airport with emphasis given to those items which can be constructed or implemented and placed in operation within one to four years. Author (TAB)

N70-33952# Pioneer Parachute Co., Inc., Manchester, Conn.
PROTOTYPE CLUSTER-PARACHUTE RECOVERY SYSTEM FOR A 50,000 POUND UNIT LOAD. VOLUME 1: DESIGN STUDY Final Report, May 1968 -Jan. 1969
Royce A. Toni, Wolfgang R. Mueller, Milan M. Knorr, and Marcia C. Wood Jan. 1969 214 p refs
(Contract DAAG17-68-C-0142)
(AD-701004; USA-NLABS-TR-69-82-AD) Avail: CFSTI CSCL 1/3

The report covers a research and development program to design and fabricate a prototype cargo-recovery parachute assembly for airdropping heavy unit loads in the order of 50,000 lb. The design study covers the trade-off analysis and cost effectiveness aspects for a complete parachute assembly. From these studies, a design analysis and complete detailed design were made based on the specified performance and design requirements. Use of data reduction on full-scale cargo drops with G-11A parachutes with vent-pull down configuration, scale model wind tunnel tests and parametric studies determined that it is feasible to use a cargo parachute of 135 ft. diam. with a vent-pull down in a cluster of six to recover a load unit of 50,000 lb. Author (TAB)

N70-33974# School of Aerospace Medicine, Brooks AFB, Tex.
COCKPIT NOISE EXPOSURES ASSOCIATED WITH THE OPERATION OF FIXED AND ROTARY WING AIRCRAFT Final Report, Jul. 1966 -Jul. 1969
Donald C. Gasaway Apr. 1970 22 p refs
(AD-705964; SAM-TR-70-21) Avail: CFSTI CSCL 20/1

Noise levels measured within the cockpits of 126 fixed- and rotary-wing aircraft were tabulated and arranged into stereotyped sets of exposure envelopes. The noise data from which these envelopes were derived represent typical unprotected exposures encountered within 12 different categories of fixed- and rotary-wing aircraft during conditions of normal cruise. Extreme or unique noise exposures were deleted from the study. Author (TAB)

N70-34001# Firestone Coated Fabrics Co., Akron, Ohio.
AN ENGINEERING INVESTIGATION AND ANALYSIS OF CRASH-FIRE RESISTANT FUEL TANKS Final Report
Merritt M. Yancey and Richard T. Headrick Jul. 1970 18 p refs
(Contract FA-67-NF-245)
(NA-69-43; DS-69-7) Avail: CFSTI

Use of available rubber, plastic and other materials to reduce probability of fire in fuel tanks during and after survivable crashes was studied. Techniques investigated apply to integral tanks and bladder cells as well. General contributions include prevention of original penetration, containment of penetration, maintenance of fuel integrity even with failure of above two systems; change in characteristics of fuel expulsion from major wound to non-vapor, low flow liquid leak; flame and explosion suppression and surge attenuation. Proper selection of "building blocks" to optimize desired performance characteristics indicates a major contribution is available with slight, almost unmeasurable displacement of usable fuel and addition of weight. Structures so protected may be inspected. Author

N70-34002# Mc Donnell-Douglas Co., Long Beach, Calif.
ECONOMIC ANALYSIS OF THE USE OF GELLED FUELS IN JET TRANSPORT AIRCRAFT Final Report
H. D. Whallon, A. T. Peacock, and L. D. Christensen Jul. 1970 64 p refs
(Contract FA-68-NF-273)
(FAA-NA-70-45; FAA-DS-70-13) Avail: CFSTI

A previous study examined the technical aspects of using gelled or emulsified fuel in a DC-8-62 commercial jet transport and identified associated problems. This study examined the economics of jet fleet conversion to the use of 2 percent gelled fuel. Based on the technical findings, a DC-8-62 analysis, it was estimated that conversion and operation for the ten years 1972-81 of all U.S. air carrier jet passenger airplanes would add about four billion dollars to their operating costs for the decade. This is approximately a 4.5 percent increase to total operating costs. Author

N70-34017*# National Aeronautics and Space Administration, Washington, D.C.
GUST EFFECTS ON THE DYNAMICS OF AIRCRAFT DURING LANDING APPROACH
P. Hamel et al May 1970 30 p refs Transl. into ENGLISH of DGLR Ann. Meeting Rept-52 Conf. held at Bremen, 22-24 Sep. 1969
(NASA-TT-F-12751) Avail: CFSTI CSCL 01C

An investigation was made of the dynamic behavior of a slender delta-wing aircraft under the influence of vertical and lateral gusts; particularly during landing approach. The results indicate that: (1) an aerodynamic coupling phenomenon considerably alters the characteristics of angle-of-attack oscillations and of aperiodic rolling motions; (2) gradients of surface boundary layers raise the gust sensitivity of lateral motions; and (3) it is possible to reduce gust sensitivity and the effects of surface boundary layer gradients by means of specified aerodynamic adjustments. Author

N70-34028*# National Aeronautics and Space Administration, Washington, D.C.
HELICOPTER TESTING IN A WIND TUNNEL [BADANIA SMIGLOWCOW W TUNELU AERODYNAMICZNYM]
Zdzislaw Brodzki Jul. 1970 8 p Transl. into ENGLISH from Biol. Inform. Inst. Lotnictwa, v. 5, May-Jun. 1968 p 7-11
Avail: CFSTI CSCL 01C

Problems encountered in wind tunnel testing of helicopters are described. Possible solutions in terms of test procedures and adopted test-bed equipment are proposed. A summary is given of the helicopter wind tunnel test program conducted in Poland for the domestic helicopter industry. Author

N70-34100*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION OF A V/STOL TRANSPORT MODEL WITH FOUR POD-MOUNTED LIFT FANS
William A. Newsom, Jr. Washington Aug. 1970 103 p refs
(NASA-TN-D-5942; L-7199) Avail: CFSTI CSCL 01C

The investigation included force and moment measurements over a range of angles of attack and sideslip through the transition speed range for several power conditions. The static longitudinal, lateral, and directional stability characteristics were determined for several configurations, and lift-fan thrust performance was measured. The model had an increase in lift with increasing airspeed and showed lateral and directional stability for all test conditions but longitudinal stability for only the higher test speeds. Flow conditions at the tail for the powered-lift condition were similar to those of conventional airplanes in terms of dynamic pressure and downwash factor, but there was a decidedly adverse sidewash effect. The adverse sidewash was compensated to a considerable extent, however, by the fact that the model was about neutrally stable, rather than unstable, with the vertical tail off. Author

N70-34160* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
NOSE GEAR STEERING SYSTEM FOR VEHICLE WITH

MAIN SKIDS Patent
Upshur T. Joyner, inventor (to NASA) Issued 28 Sep. 1965 (filed 20 Mar. 1964) 10 p Cl. 244-50
(NASA-Case-XLA-01804; US-Patent-3,208,694; US-Patent-Appl-SN-353637) Avail: US Patent Office CSCL 01C

A system is described for providing directional stability to a vehicle by applying a limited torque about the axis of a swiveling nose gear which causes the nose wheel to be skewed in the direction of travel of the vehicle, thereby establishing a ground reaction force. A steering wheel or equivalent means is provided for initiating the amount and direction of torque to be applied about the swivel axis of the nose gear. The system provides high-speed aircraft and reentry space vehicles with a flexibility of choice of landing sites. R.B.

N70-34178* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABLE-SPAN AIRCRAFT Patent
John G. Lowry, inventor (to NASA) Issued 30 Apr. 1963 (Filed 25 Jan. 1961) 5 p Cl. 244-46
(NASA-Case-XLA-00166; US-Patent-3,087,692; US-Patent-Appl-SN-84961) Avail: US Patent Office CSCL 01C

The development of an aircraft having variable aspect ratio, variable sweep wings is described such that variation of the sweep angle does not require a complex or heavy mechanism or cause a significant shift in the relative position of the aircraft center of gravity and the aerodynamic center. The configuration provides for a substantial inboard fixed 'swallowtail' wing portion to which is connected a smaller outboard pivotal 'swallowtail' wing portion. The proposed configuration maximizes aspect ratio for subsonic takeoff, climb, cruise, descent, and landing, while minimizing aspect ratio during supersonic cruise. R.B.

N70-34263*# Stanford Research Inst., Menlo Park, Calif.
INFORMATION REQUIREMENTS FOR SUPERSONIC TRANSPORT OPERATION Final Report
Lewis Meier, Charles H. Wells, Sidney Serebreny, David M. Salmon, and John Peschon Washington NASA Jul. 1970 260 p refs
(Contract NAS2-5069)
(NASA-CR-1570) Avail: CFSTI CSCL 01C

An investigation is described of the effect of atmospheric changes and errors in the measurements used to determine these changes on the vertical flight performance of an SST. Included in the report are descriptions of the models (engine, instruments, aerodynamics, atmosphere) and the optimal control theory (deterministic and stochastic) needed to determine optimal SST trajectories and their sensitivity to atmospheric variations and measurement errors. Descriptions are also given of computer programs for SST trajectory optimization and sensitivity analysis. Author

N70-34385*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FULL-SCALE WIND-TUNNEL INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF THE X-24A LIFTING BODY AIRCRAFT
Kenneth W. Mort and Michael D. Falarski (Army Aeron. Res. Lab., Moffett Field, Calif.) Washington Aug. 1970 58 p refs
(NASA-TN-D-5932; A-2823) Avail: CFSTI CSCL 01C

The aerodynamic characteristics of the X-24A aircraft were investigated in a 40- by 80-foot wind tunnel. The aircraft was tested over an angle-of-attack range of −4 deg to +32 deg, an angle-of-sideslip range of −6 deg to +6 deg, for several longitudinal, lateral, and directional control settings, and for Reynolds numbers ranging from 20.7×1000000 to 41.6×1000000. Results were obtained with the landing gear both up and down. With the landing gear up the maximum lift-to-drag ratio achieved was 5.2 untrimmed and 4.4 trimmed. With the landing gear down the maximum trimmed L/D was lower by an amount which varied from 0.8 to 1.8, depending on the upper flap deflection. In flight, lowering the landing gear would require a longitudinal control change of 7 deg to 10 deg, depending on the angle of attack, to maintain a constant lift coefficient or forward velocity. A limited comparison with 1/5 scale-model longitudinal results showed very good agreement. Author

N70-34399*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION OF AERODYNAMIC CHARACTERISTICS OF A 1/2-SCALE MODEL OF AN EJECTION SEAT WITH A RIGID-WING RECOVERY SYSTEM
Sanger M. Burk, Jr. Washington Aug. 1970 39 p refs
(NASA-TN-D-5922; L-7185) Avail: CFSTI CSCL 01C

A wind-tunnel investigation has been conducted in the Langley full-scale tunnel to determine the static longitudinal and lateral characteristics of a model of an ejection seat equipped with a rigid-wing recovery system. Several wing and vertical-tail arrangements were tested as well as various configurations of the ejection seat alone, ranging from unfaired to completely faired seats. Author

N70-34499# Human Engineering Labs., Aberdeen Proving Ground, Md.
TACTICAL UTILITY HELICOPTER INFORMATION TRANSFER STUDY
John A. Barnes Mar. 1970 103 p refs
(AD-705594; HEL-TM-7-70) Avail: CFSTI CSCL 1/3

The task requirements of the Tactical Utility Helicopter Mission were enumerated and experienced pilots have indicated the instrumentation they feel is necessary to perform these tasks. Film of eye movement was taken for two of the pilots while they were flying missions that encorporated these tasks. The film and the pilot replies were analyzed to provide the information transfer requirements for the Tactical Utility Helicopter flight instrumentation. Author (TAB)

N70-34625# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING CORPORATE/EXECUTIVE AIRCRAFT, US GENERAL AVIATION, 1967
[1970] 51 p
(PB-190409) Avail: CFSTI CSCL 01B

This report contains the briefs of accidents involving corporate/executive aircraft occurring in 1967. There were 119 accidents involving this kind of flying out of a total of 6,115 general aviation accidents in 1967. Collisions between aircraft are treated as one accident. A complete analysis and coding is done on each aircraft involved in collisions. This produces two aircraft accident records, one for each aircraft involved in the collision. Consequently, when compiling information on accidents involving collisions between aircraft, the number of accident records will exceed the number of accidents. The injury and cause/related tables show the number of accidents. All analytic tables show both records and accidents. Author (USGRDR)

N70-34571# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING MISSING AIRCRAFT; US GENERAL AVIATION, 1967
[1970] 61 p
(PB-190412) Avail: CFSTI CSCL 01B

This report contains the briefs of accidents involving missing aircraft occurring in 1967. There were 22 accidents involving this type of accident out of a total of 6,115 general aviation accidents in 1967. Collisions between aircraft are treated as one accident. A complete analysis and coding is done on each aircraft involved in collisions. This produces two aircraft accident records, one for each

aircraft involved in the collision. Consequently, when compiling information on accidents involving collisions between aircraft, the number of accidents records will exceed the number of accidents. The injury and cause/related tables show the number of accidents. All analytic tables show both records and accidents.
Author (USGRDR)

N70-34576# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING ALCOHOL AS A CAUSE/FACTOR, US GENERAL AVIATION, 1967
[1970] 15 p
(PB-190413) Avail: CFSTI CSCL 01B

This report contains the briefs of accidents involving alcohol as a cause/factor occurring in 1967. There were 49 accidents involving this cause factor out of a total of 6,115 general aviation accidents in 1967. Collisions between aircraft are treated as one accident. A complete analysis and coding is done on each aircraft involved in collisions. This produces two aircraft accident records, one for each aircraft involved in the collision. Consequently, when compiling information on accidents involving collisions between aircraft, the number of accidents records will exceed the number of accidents. The injury and cause/related tables show the number of accidents. All analytic tables show both records and accidents.
Author (USGRDR)

N70-34630# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF ACCIDENTS INVOLVING AMATEUR/HOME BUILT AIRCRAFT, US GENERAL AVIATION, 1967
[1970] 331 p
(PB-190410) Avail: CFSTI CSCL 01B

Briefs of Accidents involving Amateur/Home Built aircraft occurring in 1967 are reported. There were 63 accidents involving this model aircraft out of a total of 6,115 General Aviation accidents in 1967. Collisions between aircraft are treated as one accident. A complete analysis and coding is done on each aircraft involved in collisions. This produces two aircraft accident records, one for each aircraft involved in the collision. Consequently, when compiling information on accidents involving collisions between aircraft, the number of accident records will exceed the number of accidents. The injury and cause/related tables show the number of accidents. All analytic tables show both records and accidents.
Author (USGRDR)

N70-34643# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
REVIEW OF CORPORATE/EXECUTIVE AIRCRAFT ACCIDENTS: A STATISTICAL SUMMARY OF A SPECIAL/SEGMENT OF US GENERAL AVIATION, 1964 - 1968
12 Mar. 1970 140 p
(PB-190408) Avail: CFSTI CSCL 01B

Information in the review was developed from a special file of 439 corporate/executive aircraft accidents that occurred during the period 1964 - 1968. Criteria used in the selection of these accidents were: Each aircraft was corporate owned or operated; each accident involved a corporate/executive operation; i.e., flown in a corporate operation by a professional pilot; the pilot-in-command was a holder of a commercial or airline transport pilot certificate; and the aircraft was of U.S. registry. The review contains analytic tables in matrix form comparing selected accident information, and cause/related factor tables and injury tables covering various segments of the entire file.
Author (USGRDR)

N70-34684# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS ON ACCIDENTS INVOLVING MIDAIR COLLISIONS, U.S. GENERAL AVIATION, 1967
[1970] 28 p
(PB-190411) Avail: CFSTI CSCL 01B

This report contains the Briefs of Accidents involving midair collisions occurring in 1967. There were 26 accidents involving this type of accident out of a total of 6,115 general aviation accidents in 1967. There are no accident rates compiled for this type of accident due to unavailability of exposure data. Collisions between aircraft are treated as one accident. A complete analysis and coding is done on each aircraft involved in collisions. This produces two aircraft accident records, one for each aircraft involved in the collision. Consequently, when compiling information accidents involving collisions between aircraft, the number of accidents records will exceed the number of accidents. The injury and cause/related tables show the number of accidents. All analytic tables show both records and accidents.
Author (USGRDR)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-33748*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
A SIMPLE EMPIRICAL FORMULATION OF ELECTRON EMISSION FROM CESIATED METAL SURFACES
John R. Smith and Arthur L. Smith 1969 7 p refs Presented at the Thermionic Conversion Specialist Conf., Carmel, Calif., 21 - 23 Oct. 1969; Sponsored by IEEE
(NASA-TM-X-52716) Avail: CFSTI CSCL 10B

Cathode emission current densities and anode work functions are necessary inputs to the analysis of thermionic converter systems. These inputs must agree with existing experimental results and be free of ambiguity. A simple empirical equation giving the emission current density in terms of the cesium atom arrival rate and the surface temperature is provided here. The Swanson - Strayer correlation for the maximum change in work function due to cesium adsorption is discussed.
Author

N70-33756*# Ion Physics Corp., Burlington, Mass.
SILICON SOLAR CELL DEVELOPMENT FOR LOW TEMPERATURE AND LOW ILLUMINATION INTENSITY OPERATION, VOLUME 1 Analysis Report, 30 Jun. 1969 - 30 Apr. 1970
A. R. Kirkpatrick, J. C. Ho, and F. T. C. Bartels 30 Apr. 1970 47 p refs
(Contract NAS2-5516)
(NASA-CR-73465) Avail: CFSTI CSCL 10B

Examination has been made of the factors which influence solar cell performance at low temperatures under low illumination intensity. The causes of deficient operational performance have been identified. Corrective measures have been developed. Output maximization for -135 C operation under 1/26 solar constant illumination is in progress.
Author

N70-33965*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.
RESEARCH DEVELOPMENT AND FABRICATION OF LITHIUM SOLAR CELLS Quarterly Report
Peter A. Iles 15 Apr. 1970 22 p Prepared for JPL
(Contracts NAS7-100; JPL-952546)
(NASA-CR-109802; QR-3) Avail: CFSTI CSCL 10B

The means for improving lithium cells involve the use of crucible grown silicon, reduced boron diffusion cycles, and the use of lower temperature lithium cycles (below 400 C) with

correspondingly longer diffusion times—up to 8 hours. Detailed evaluation of the lithium concentration, both near the back surface and near the P/N junction, has led to better understanding of the differences shown by oxygen-rich (CG) and three forms of oxygen-lean silicon. It is now possible to provide adequate lithium in 1 × 2 cm cells for several likely missions and to obtain medium yields for AMO maximum power output over 30mW for CG silicon, and over 29mW for Lopex silicon. Author

N70-33988*# Texas Technological Univ., Lubbock. Dept. of Geosciences.
MARTIAN ENVIRONMENTAL EFFECTS ON SOLAR CELLS AND SOLAR CELL COVER GLASSES Quarterly Report
F. Alton Wade 15 Jul. 1970 18 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952582)
(NASA-CR-109841; TTU-3101; QR-4) Avail: CFSTI CSCL 10B

The project includes the subjection of solar cell assemblages to dust storms in wind tunnels where simulated Martian environmental conditions prevail. The electrical performance of the solar cells is determined by tests before and after subjecting the cell assemblages to dust storms. Damage to the cover glasses and cells is assessed by microscopic examinations and measurements. To date all tunnel runs have been completed; eight at ambient temperaturss, eight at 245 K, and eight with diurnal temperature range of 233 K-293 K. Electrical performance has been determined on 50% of assemblages following tunnel runs. No detailed damage assessments have been concluded. Author

N70-34005*# Idaho State Univ., Pocatello. Dept. of Chemistry.
INVESTIGATION OF ELECTRODE MATERIALS FOR ALKALINE BATTERIES Quarterly Report
G. Myron Arcand 25 Aug. 1969 23 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952265)
(NASA-CR-109858; QR-5) Avail: CFSTI CSCL 10C

The viscosities of KOH solutions ranging from 6 VF to saturated have been determined at 25 deg. Preliminary experiments indicate that a thermal method for determining the silver species on an electrode is fessible. Wet samples can be dried near 100 deg without causing significant decomposition. AgO can be decomposed to Ag2O at 230 deg without significant formation of metallic silver. Ag2O can be reduced to the metal at 400 deg. Potassium-amalgam electrodes have been discharged at current-densities of about 8.1 A/sq cm with about 80% recovery of charge. Similar electrodes have been charged at the same rate with 90% recovery of charge. There is evidence that the total amount of charge in the electrode affects the recovery, poorer recovery being obtained at higher total charge. Initial gas-evolution experiments show that a potassium-amalgam electrode self-discharging into saturated KOH will lose about 2% of its initial charge in the first 5 days. Extrapolation of these data indicate that more than 125 days should be required for 50% self-discharge of this type of electrode. Author

N70-34013*# Texas Instruments, Inc., Attleboro, Mass. Research and Development Labs.
HEAT STERILIZABLE AND IMPACT RESISTANT Ni-Cd BATTERY DEVELOPMENT. VOLUME 2: ENGINEERING DESIGN AND EVALUATION Final Report, Jan. 1969–Jan. 1970
E. J. Rubin Jan. 1970 108 p Prepared for JPL
(Contracts NAS7-100; JPL-951972)
(NASA-CR-109855; TI-51-70-8) Avail: CFSTI CSCL 10C

This investigation involves the study of high energy density plate materials and an evaluation of hermetic seals, and other structural components and fabrication techniques. The stability of these components in the cells' internal environment and their effects on cell performance were used as measurement criteria. Particular attention and effort were devoted to seal evaluation. Other engineering tasks included manufacture and evaluation of sintered nickel plate for use as high energy density plates capable of delivering a capacity density of eleven ampere hours per cubic inch. Author

N70-34014*# Texas Instruments, Inc., Attleboro, Mass. Research and Development Labs.
HEAT STERILIZABLE AND IMPACT RESISTANT Ni-Cd BATTERY DEVELOPMENT. VOLUME 1: ELECTROCHEMISTRY OF HEAT-STERILIZABLE SEALED CELLS Final Report, 1 Jul. 1967–31 Dec. 1969
R. L. Crawford and P. V. Popat 31 Dec. 1969 227 p ref Prepared for JPL
(Contracts NAS7-100; JPL-951972)
(NASA-CR-109854) Avail: CFSTI CSCL 10C

The major objectives of this program were: Research, development, engineering design, fabrication, testing and delivery of heat-sterilizable, nickel-cadmium space cells, capable of 400 post-sterilization cycles at 50% depth-of-discharge. In addition, it was required to develop heat-sterilizable, nickel-cadmium cells and components with an impact-resistance capability of up to 4000 g. Author

N70-34053# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATIC MULTIPOLE ACYCLIC GENERATOR WITH A SUPERCONDUCTING SHIELD
V. P. Kartsev et al 30 Mar. 1970 22 p refs Transl. into ENGLISH from Zv. Vyssh. Ucheb. Zaved., Elektromekhan. (Novocherkassk), v. 9, no. 6, 1966 p 595–605
(AD-705847; FTD-MT-24-38-70) Avail: CFSTI CSCL 10/2

An improvement of the Volger and Admiraal acyclic superconducting-shield generator is proposed. Essentially, a 12-pole 3-phase system without any moving mechanical parts is suggested to effect the ac/dc power inversion at helium temperature. TAB

N70-34078*# Heliotek, Sylmar, Calif.
RESEARCH AND DEVELOPMENT OF SILICON SOLAR CELLS FOR LOW SOLAR INTENSITY AND LOW TEMPERATURE APPLICATIONS
P. Payne 26 Feb. 1970 27 p
(Contract NAS2-5519)
(NASA-CR-73467) Avail: CFSTI CSCL 10B

Continuing research in a program to obtain a solar cell design optimized for 5.0 mW/sq cm, -135 C operation as encountered in a spacecraft mission to Jupiter is reported. Results of experiments conducted to analyze and optimize the important variables are presented. In the investigation of design variables the broken knee effect was stressed since it could seriously limit the output of cells at Jupiter test conditions. Research dealing with this problem is described and test data are summarized. Author

N70-34134* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENERGY CONVERSION APPARATUS Patent
James E. Hatch, inventor (to NASA) Issued 24 Aug. 1965 (filed 8 Nov. 1961) 4 p Cl. 310-4
(NASA-Case-XLE-00212; US-Patent-3,202,844;
US-Patent-Appl-SN-151598) Avail: US Patent Office CSCL 10B

A device is described for direct conversion of thermal energy into electrical energy, using crossed electrical and magnetic fields. Conversion is accomplished by heating an electron-emissive plate contained in a spaced relationship to an electron collector plate. Electrons removed from the electron-emissive plate by heating are accelerated towards an accelerator grid by an electric field established between the plates and grid. A shaped magnet provides a unidirectional nonuniform magnetic field at right angles to the electric field causing the electrons to follow noncolliding circular paths between the electron-emissive plate and the collector plate. R.B.

N70-34157* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE VEHICLE ELECTRICAL SYSTEM Patent

Robert J. Schwinghamer, inventor (to NASA) Issued 7 Sep. 1965 (filed 10 Aug. 1962) 7 p Cl. 244-1

(NASA-Case-XMF-00517; US-Patent-3,204,889; US-Patent-Appl-SN-216711) Avail: US Patent Office CSCL 10B

An electrical power system for space flight vehicles operating for extended periods is described. The outer skin and other structural elements of the vehicle are fabricated from an integral construction of metal sheets separated from other structures by a high value dielectric constant material, thereby forming a bank of discrete capacitors. A high voltage charging source is connected through switching elements to any desired number of capacitors. The capacitor outputs may also be coupled to the different electrical utilization or load circuits of the vehicle. The vehicle contains an electrical engine particularly adapted for pulse or intermittent operation. R.B.

N70-34429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SPECTRAL RESPONSES OF SILICON SOLAR CELLS AT LOW TEMPERATURE

Henry W. Brandhorst, Jr., and Russell E. Hart, Jr. [1970] 11 p refs Presented at the 8th Photovoltaic Specialists Conf., Seattle, 4-6 Aug. 1970

(NASA-TM-X-52870) Avail: CFSTI CSCL 10B

Spectral responses were measured at temperatures down to 95 K for silicon solar cells with poor and good performance at low temperatures. Poor cells had either a rectifying rear contact or a flat spot on the I-V curve and a rapid decrease in I sub SC at low temperatures. Good cells showed a gradual loss in red response that was due to the change of absorption coefficient with temperature. A further loss in red response was responsible for the rapid decrease in current in poor cells. The flat spot and the loss in current appear to be related. Author

N70-34560*# Boeing Co., Seattle, Wash.

SOLAR CELL ASSEMBLY TEST METHOD Patent Application

Charles W. Cable, inventor (to NASA) Filed 27 Feb. 1970 16 p Prepared for JPL

(Contract NAS7-100; JPL-951653)

(NASA-Case-NPO-10401; US-Patent-Appl-SN-15025) Avail: CFSTI CSCL 10B

The method and apparatus for a simplified and accurate technique to test the integrity of interconnection and output performance of the individual and interconnected cells of solar cell assemblies is described. The inventive technique may be used alone or in conjunction with usual solar simulation, vibration thermal and other tests to locate intermittent faults without disturbing the cells or interconnectors. NASA

N70-34623*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

FLOW CHARACTERISTICS OF THE LUNAR MODULE WATER MANAGEMENT SYSTEM: PROGRAM APOLLO

R. Trabanino 1 Jul. 1969 78 p

(NASA-TM-X-64353; MSC-69-00116) Avail: CFSTI CSCL 13L

In-house tests were conducted on the lunar module water management system simulator to determine the flow characteristics of the water management system from the tanks through the firefighting/water dispenser interface. The system pressure losses and flow rates were measured along the water delivery lines downstream of the descent and ascent water storage tanks, at various tank pressures, with the water dispenser/fire extinguisher attached to the end of the flex hose assembly. These are the lines confined to the water dispenser and portable life support system. The test program described in this document presents the results of the tests carried out to determine the flow characteristics of the lunar module water management system and provides basic flow data for additional testing of the fire fighting system. Author

N70-34646*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THERMIONIC TANTALUM EMITTER DOPED WITH OXYGEN Patent Application

Scott S. Luebbers and John G. De Steese, inventors (to NASA) Filed 21 Oct. 1969 19 p

(Contract NAS7-100)

(NASA-Case-NPO-11138; US-Patent-Appl-SN-9251) Avail: CFSTI CSCL 10B

An oxygen-doped tantalum emitter for thermionic devices, such as cesium vapor diodes, is described. The level of current obtainable is more than a magnitude greater than that expected from a tantalum electrode. NASA

N70-34667* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

GAS ACTUATED BOLT DISCONNECT Patent

William H. Kinard, inventor (to NASA) Issued 17 Aug. 1965 (filed 23 Oct. 1963) 8 p Cl. 89-1

(NASA-Case-XLA-00326; US-Patent-3,200,706; US-Patent-Appl-SN-318443) Avail: US Patent Office CSCL 13E

A gas actuated bolt disconnect assembly is described for detachably securing two parts (e.g., a cable and weight, two ends of a tension cable connecting a jettisonable satellite to a rocket propelling vehicle, or rocket stage connections) that are desired to be releasably connected. The assembly quickly disconnects two connected parts without the danger of shrapnel or explosively propelled debris damage. E.C.

N70-34672*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DELAYED SIMULTANEOUS RELEASE MECHANISM Patent Application

Xopher W. Moyer and John B. Webb, inventors (to NASA) Filed 28 May 1970 16 p

(NASA-Case-GSC-10814-1; US-Patent-Appl-SN-41404) Avail: CFSTI CSCL 13I

An appendage release mechanism is described which is particularly adapted for use with spacecraft operating with despin mechanisms and releasable appendages. It includes a flexible loop and a plurality of appendage releasing devices which are attached to the flexible loop. The release devices are made up of piston-cams and ball latches which hold the appendages as long as the flexible loop is maintained in a taut condition but which release the appendages upon relaxation of the flexible loop. The flexible loop remains taut as long as the despin weights, which are attached to the flexible loop by cords, remain attached but relaxes when the despin weights are released. NASA

N70-34686*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ELECTRIC STORAGE BATTERY Patent Application

Thomas H. Purcell, Jr. and Alfred W. Jordan, inventors (to NASA) Filed 26 Nov. 1969 32 p

(Contract NAS7-100)

(NASA-Case-NPO-11021; US-Patent-Appl-SN-880250) Avail: CFSTI CSCL 10C

An electric storage battery is described that is particularly suited for resisting forces experienced in an impact environment. It is characterized by a plurality of flexible, narrow battery plates, of opposite polarities, suspended within a sealed housing having a pair of parallel internal surfaces including a plurality of grooves. The grooves support the plates of one polarity along opposed vertical surfaces, while the plates of the other polarity are suspended in a manner such that the plates of the first polarity impart lateral support to the plates of both polarities in an impact environment. NASA

N70-34738*# General Electric Co., Cincinnati, Ohio.
CORROSION TESTS OF LITHIUM FLUORIDE IN CONTACT WITH COLUMBIUM ALLOYS. LITHIUM FLUORIDE BELLOWS CAPSULE TESTS Topical Report No. 2
R. W. Harrison and W. H. Hendrixson 29 Jan. 1970 124 p
(Contract NAS3-8523)
(NASA-CR-109932; GESP-436) Avail: CFSTI CSCL 10B

The compatibility was determined for several promising columbium-base alloys with lithium fluoride under the cyclic thermal conditions simulating the sun-shade cycle of a heat receiver. A design concept for containment of lithium fluoride in a manner to accommodate the 29 percent expansion on melting was evaluated. The compatibility test results concluded that the columbium-base alloys Cb-1Zr, FS-85, and SCb-291 were corrosion resistant to lithium fluoride. Author

N70-34790*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRICAL PERFORMANCE OF A 2- TO 10-KILOWATT BRAYTON ROTATING UNIT
Robert C. Evans and Sheldon J. Meyer Washington Aug. 1970 28 p refs
(NASA-TM-X-2062; E-5643) Avail: CFSTI CSCL 10B

The Brayton rotating unit with electronic voltage and speed control was operated as part of a closed loop laboratory test facility. The results are presented from electrical tests conducted during 475 hours of operation at output power levels ranging from 1 to 15 kW and lagging power factors of 0.73 to 0.95. The level of neutral current was not constant but varied with parasitic load. Small load fluctuations were observed as each speed controller began to apply parasitic load and at the 3-kW load point for each unit. The electrical system was stable for all transient useful loads investigated. The alternator armature windings operated with higher temperatures at design load (10.7 kW, 0.75 power factor) than predicted. Author

N70-34797*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.
RESEARCH AND DEVELOPMENT OF SILICON SOLAR CELLS OPTIMIZED FOR SPACE EXPLORATION POWER SYSTEMS Quarterly Report, 1 Apr. – 30 Jun. 1970
Peter A. Iles and James M. Palmer 17 Jul. 1970 16 p ref
Prepared for JPL
(Contracts NAS7-100; JPL-952865)
(NASA-CR-109859; QR-1) Avail: CFSTI CSCL 10B

Results of the first three months of an effort to develop silicon solar cells optimized for space exploration power systems are reported. The major emphasis to date has been on solar cells for near-sun missions (Mercury and Venus). Attention has been focussed on thermal characteristics and series resistance. Production of sample cells has begun. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-33424# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
BLOOD ALCOHOL CONCENTRATIONS AS AFFECTED BY COMBINATIONS OF ALCOHOLIC BEVERAGE DOSAGES AND ALTITUDES
E. Arnold Higgins, John A. Vaughan, and Gordon E. Funkhouser Apr. 1970 11 p refs
(AM-70-5) Avail: CFSTI

Blood alcohol levels in man were established at 12,000 ft. with and without supplemental oxygen and at 20,000 ft. with supplemental oxygen. At 2.50ml. of 100 proof bourbon/kg. body weight, subjects exhibited a lower blood alcohol level at 12,000 ft. without supplemental oxygen than at 20,000 ft. with supplemental oxygen. A difference in blood alcohol levels was not seen with 1.25 ml. of 100 proof bourbon/kg. body weight. It was established that dehydration effects alone could not account for these findings. The effect of breathing a normal oxygen mixture could not be ascertained with the data collected. An increased motility of the gastro-intestinal tract and the increased motility attributable to the lowered barometric pressure could increase the absorption rate of the alcohol at 20,000 ft. with the high dose, thereby contributing to higher blood alcohol levels. Author

N70-33472# Comitato Nazionale per l'Energia Nucleare, Roma (Italy).
ON THE RADIATION AVERAGE DOSE ABSORBED BY TRUCK DRIVERS IN ITALY
C. Faloci and A. Susanna 10 Apr. 1970 42 p refs Presented at the 15th Natl. Conf. of the Ital. Health Phys. and Radiation Protect. Assoc., Cagliari, Italy, 29 Sep. – 3 Oct. 1969 Submitted for publication
(RT/PROT(70)7) Avail: CFSTI

A study was conducted for the purpose of estimating the average dose absorbed by truck drivers in the years 1967 and 1968. In the course of the study a statistical survey was also made on the shipments of radioactive materials which took place in Italy in the said period, determining the distribution frequency on the radionuclides most commonly used for therapeutical, diagnostic, industrial and research purposes. In conducting the survey, constant attention was given to the objective of identifying the protection problems connected with the shipping activities. Comparisons of road and air traffic shipments of different types of radioisotope packages are given. Conclusions are drawn concerning the number of imports and exports by air traffic of these radioisotope packages. Author

N70-33486# Dayton Univ., Ohio. Research Inst.
BIOMAGNETIC RESPONSE OF SIMPLE BIOLOGICAL SYSTEMS AND THE IMPLICATIONS FOR LONG DURATION SPACE MISSIONS Technical Report, Apr. – Dec. 1965
John L. Cashin, Jr. and George C. Mohr (AMRL) Wright-Patterson AFB, Ohio AMRL Jan. 1970 19 p refs Presented at the 37th meeting of the Aerospace Medical Assoc., Las Vegas, Nev., Apr. 1966
(Contract AF 33(615)-2821)
(AD-705648; AMRL-TR-68-32) Avail: CFSTI CSCL 6/3

Several space age technological developments employ powerful magnetic fields in a manner that can subject the human operator to intense levels of magnetic exposure. Examples include magnetic forming tools, magnetic shielding, magnetohydrodynamic propulsion systems, and various magnetic containment devices. Reports in the literature have implied that rapidly metabolizing tissues may be affected by intense, inhomogeneous magnetic fields. To investigate this hypothesis, two ideal biological systems were exposed to fields of approximately 4,000 oersted intensity and gradients of 500 to 2,000 oersteds per cm. The oxygen uptake rate of fresh guinea pig kidney brie enriched with succinate was measured by Warburg manometry for magnetically exposed and control samples. The difference between uptakes was statistically evaluated using a sequential t-test. In a second experiment, the growth rate of E. coli was measured for exposed and control cultures, employing the viable plate count technique. The sequential t-test was again used. The results indicated that the magnetic exposure had no significant effect on either biologic system. Author (TAB)

N70-33521# Michigan Univ., Ann Arbor. Human Performance Center.
MONITORING EYE MOVEMENTS DURING THE LEARNING OF PAIRED-ASSOCIATE LISTS
P. D. Mc Cormack Mar. 1970 89 p refs
(Contract AF 49(638)-1736; Grant NRC APA-78)
(AD-705646; TR-20; AFOSR-70-1083TR; REPT-08773-57-T) Avail: CFSTI CSCL 5/10

Eye movements were monitored during the learning of paired associates in each of 14 studies. The fixation, eye movement and learning data were all generally compatible with a two-stage conceptualization of paired-associate learning, as well as with the notion of stimulus encoding. The first stage, that of response consolidation, appears to be brief, and may be interfered with under certain sets of conditions. A theoretical model is presented which stresses the importance of the role of short-term memory during the acquisition of paired-associate lists. Author (TAB)

N70-33622# Naval Postgraduate School, Monterey, Calif.
THE EFFECTS OF SLEEP LOSS AND DEMANDING WORK/REST CYCLES: AN ANALYSIS OF THE TRADITIONAL NAVY WATCH SYSTEM AND A PROPOSED ALTERNATIVE
William Charles Stolgitis (M.S. Thesis) Oct. 1969 29 p refs
(AD-706027) Avail: CFSTI CSCL 6/19

An analysis of the traditional Navy watch system and a proposed alternative is presented. Current research on sleep deprivation and the effects of demanding work/rest schedules is documented and discussed as a basis for key assumptions in the analysis. Methodology is also presented for determining the relative ability of the two schedules to meet the assumed minimum sleep requirements. The results favor the alternate schedule as efficient for allocating available time resources to meet established sleep requirements. Author (TAB)

N70-33631# United Kingdom Atomic Energy Authority, Harwell (England). Health and Safety Branch.
RADIOTHERMOLUMINESCENT DOSIMETRY Report of a Panel of the UKAEA Health Physics Coordinating Committee
W. N. Saxby and D. F. White, eds. Jan. 1970 20 p refs
(AHSB(RP)R-95) Avail: AEC Depository Libraries

The Health Physics Coordinating Committee of the UKAEA set up a panel on radiothermoluminescent dosimetry in 1966. An edited version of the report and recommendations made by the panel to the HPCC in December, 1968, as amended by the latter Committee is presented. It deals with current work and progress in the United Kingdom in the field of radiothermoluminescent dosimetry (TLD), with the capabilities and applications of TLD, with current and future research and development work and with the rationalization of equipment and procedures. The Panel membership represented almost all those UK bodies actively involved in TLD work in radiological protection, and constituted a useful discussion group for the exchange of information in this field. Author (NSA)

N70-33896# Naval Submarine Medical Center, Groton, Conn. Medical Research Lab.
THE EFFECTS OF ORAL ADMINISTRATION OF MAGNESIUM OXIDE ON RENAL CALCIUM EXCRETION IN CREW MEMBERS DURING A SUBMARINE PATROL
Clayton T. Drake 28 Oct. 1969 11 p refs
(AD-705391; SMRL-MR-601) Avail: CFSTI CSCL 6/15

In order to learn the effects of orally administered magnesium oxide on the excretion of urinary calcium and phosphorus, a study was undertaken on a group of forty submariners while on a routine patrol. Half of the group received daily dosages of magnesium oxide, while the other half served as controls. Twenty-four-hour specimens were collected from these subjects three days after submergence, and again a few days before return to port. Urine specimens were examined microscopically, then measured for calcium, phosphorus and routine factors. No specimen examined was found to contain bacteria, or white blood cells, nor was there any alteration in the routine chemistries. Total urinary calcium excretion in the control group fell from a mean of 178 mg in prepatrol tests to 135 mg post-patrol, while the group ingesting magnesium oxide exhibited a sample mean of 162 mg in the post-patrol tests. These figures show a significantly different mean value ($p < 0.05$). These results, if substantiated by further studies, would argue strongly for the prophylactic use of magnesium for protection against the formation of urinary calculi. Author (TAB)

N70-33878*# Scripta Technica, Inc., Washington, D.C.
EXPERIMENTAL RESEARCH ON HUMANS IN A STATE OF HYPOTHERMIA RESULTING FROM BEING CONFINED TO A LIFE RAFT ON THE OPEN SEA [RICHERCHE SPERIMENTALI SULL'UOMO IN IPOTERMIA DA PERMANENZA SU MEZZI DI SALVATAGGIO IN MARE]
P. Rota NASA Apr. 1970 24 p refs Transl. into ENGLISH from Riv. Med. Aeronaut. Spaz. (Italy), v. 32, Apr.–Jun. 1969 p 215–230
(Contract NASw-1964)
(NASA-TT-F-12885) Avail: CFSTI CSCL 06S

Physiological parameters (tympanic and superficial temperatures, heart rate, oxygen intake) were recorded in subjects donning water soaked flight suits, in low temperature and high ventilation environment. On the basis of recorded physiological data and of calculated ones (mean body temperature, thermic balance), thermal conditions and thermo-regulatory responses are studied. Considerations are presented on importance of these conditions in survival. Author

N70-33884# Naval Submarine Medical Center, Groton, Conn. Medical Research Lab.
PERFORMANCE EFFECTS OF INCREASED AMBIENT PRESSURE. 2: HELIUM-OXYGEN SATURATION AND EXCURSION DIVE TO A SIMULATED DEPTH OF 1100 FEET Interim Report
James W. Parker 10 Sep. 1969 21 p refs
(AD-705389; SMRL-598) Avail: CFSTI CSCL 6/19

Two experienced, commercial divers were administered a simple addition test, a letter cancellation test, a geometric forms test and a choice reaction time test (RATER) at selected intervals before, during and after a simulated, helium-oxygen dive in a pressure chamber complex to a saturated depth of 800 feet with excursion dives to 1000, 1050 and 1100 feet. The compression rate was 3.5 per minute. Few, if any decrements in performance on any of the measures were noted. In fact, in some instances, slight improvements were found which cannot be attributed to learning or practice effort. Most changes were postulated as being due to motivational factors. Future plans for continued validation of the performance measures used are present. Author (TAB)

N70-33914# Oak Ridge National Lab., Tenn. Mathematics Div.
THE SIMULATION, FITTING, AND TESTING OF A STOCHASTIC CELLULAR PROLIFERATION MODEL
David G. Hoel and Toby J. Mitchell Feb. 1970 29 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2811) Avail: CFSTI

A stochastic model for the growth of a cell population is proposed, and is studied by means of simulations on a digital computer. This model considers each generation time to be the sum of two successive random time intervals. The first, which depends on the population size, is the time from birth until the cell is committed to divide. The second is the time from commitment to divide until division itself. In order to fit this model to experimental data, repeated computer simulations are performed and the distance between the data and the simulated trials is studied. By viewing the expectation of this distance as a response surface over the parameter space of the model, standard response

surface methods may be used to optimize the fit. Monte Carlo procedures for testing the goodness-of-fit of these models are proposed and carried out. Author

N70-33915# Politecnico di Torino (Italy). Ist. di Fisica Tecnica.
ON METHODS FOR GENERATING MONODISPERSED AEROSOLS [SUI METODI PER LA GENERAZIONE DI AEROSOL MONDISPERSO]
C. Boffa Sep. 1968 18 p refs In ITALIAN
(PT-IFT-378; IFT-10) Avail: CFSTI

Various techniques for producing aerosols are examined for the possibility of generating reproducible monodispersions of particles, with dimensions on the order of a few hundreths of a micron, for use in studying atmospheric pollution. It is shown that the best method for producing this type aerosol is by obtaining the particles by electric arc between two metallic electrodes. Transl. by F.O.S.

N70-33930# Joint Publications Research Service, Washington, D.C.
SIGNIFICANCE OF VISUAL INFORMATION IN FORMING SPATIAL PERCEPTION IN WEIGHTLESSNESS
L. A. Kitayev-Smyk 24 Jul. 1970 8 p refs Transl. into ENGLISH from Vop. Psikhologii (USSR), no. 2, 1970 p 155-159
(JPRS-51025) Avail: CFSTI

In-flight experiments to investigate the correlation of afferent impulses in man in the process of forming spatial concepts in weightlessness are discussed. Subjects were tested strapped in a seat with eyes open, strapped in the seat with eyes blindfolded, floating in air with eyes open, and floating in air with eyes blindfolded. The nature of spatial perception was also tested by having the subjects walk on an adhesive strip located on the ceiling of the aircraft cabin. Results confirm the hypothesis that space perception during short exposures to weightlessness is formed by visual information about the stability of the surroundings and by graviceptor information about the disappearance of resistance. In the absence of sight information, the graviceptor information gave the illusion of falling, while with sight the subjects felt they were upside down. The walking experiment results agreed with earlier findings that skin and muscle sensations play an important role in weightlessness with vision left intact. N.E.N.

N70-33941*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Applied Science Div.
THE DEVELOPMENT OF TWO CLOSELY CONTROLLED HUMIDITY SYSTEMS
Daniel M. Garst and Kermit F. Lindell Jun. 1970 17 p ref
(NASA Order W-12853)
(NASA-CR-109869; SC-RR-70-409) Avail: CFSTI CSCL 06M

Accurately controlled humidity systems were needed to study the effect of relative humidity on the dry heat and thermoradiation inactivation of microorganisms. Two different systems were developed which provided the degree of control needed. The components and operation of the systems, as well as some of the factors considered in their design are described. Author

N70-33956# Missouri Botanical Garden, St. Louis.
LIGHT AND TEMPERATURE DEPENDENCE OF PHOTOSYNTHESIS Final Report, 1 Nov. 1968 - 14 Feb. 1970
David M. Gates 24 Feb. 1970 5 p
(Contract N00014-69-C-0048)
(AD-705516; MBG-ONR-001) Avail: CFSTI CSCL 6/1

A very brief report on a theoretical model for photosynthesis is given. It combines the resistance network used in transpiration studies with a simplified biochemical approach describing the uptake of CO2 at the chloroplasts. This model was combined with the energy budget approach to leaf energy balance. The photosynthesis model has been refined to include photorespiration, thereby making it more widely applicable. Author (TAB)

N70-33975# School of Aerospace Medicine, Brooks AFB, Tex.
EFFECT OF HYPOBARIC ENVIRONMENTS ON THE SUSCEPTIBILITY OF MICE TO BACTERIAL TOXINS Progress Report, Jan. - May 1969
William G. Glenn Apr. 1970 17 p refs
(AD-705907; SAM-TR-70-18) Avail: CFSTI CSCL 6/20

Two toxin-producing bacteria, Staphylococcus spp. and Salmonella enteritidis, affect man and other animals. Staphylococci produce enterotoxin of the B type (SEB) that is responsible for food poisoning. S. enteritidis produces a lipopolysaccharide (LPS) that is both pyrogenic and toxic for humans. SEB and LPS together act as synergists in mice. Neither toxin, separately, is markedly lethal. Injected in sequence, they cause substantial lethality. Twenty-one experiments were conducted at 27,000 ft. simulated altitude with varying gaseous environments and temporal sequences of SEB- and LPS injections in mice. These studies established that hypobaric environments decreased the susceptibility of mice to the lethal effects of the SEB-LPS combination when the animals remained at altitude. This was true whether the mice were acclimatized or not and regardless of the gaseous composition. Greatest resistance or least susceptibility to toxins was demons was demonstrated at 27,000 ft. simulated altitude with 50% O2-50% N2. TAB

N70-33983*# Ohio State Univ., Columbus. Dept. of Physiology.
BIOLOGICAL EFFECTS OF PROLONGED EXPOSURE OF ANIMALS TO UNUSUAL GASEOUS ENVIRONMENTS Semiannual Report, 1 Sep. 1969 - 28 Feb. 1970
Harold S. Weiss 28 Feb. 1970 5 p
(Grant NGR-36-008-004)
(NASA-CR-108426; Rept-15) Avail: CFSTI CSCL 06C

A table representing lung and body weight changes in rats exposed for 10 to 20 days to 74% O2 at one atmosphere, with and without inert gas diluents is presented. Results indicate effects on the lungs is a fairly specific response to both O2 and He and helium has some moderating effect on pulmonary oxygen toxicity. E.M.C.

N70-33999# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
EFFECTS OF AN ORGANOPHOSPHORUS PESTICIDE ON REPRODUCTION IN THE RAT
Leonard C. Ryan, Boyd R. Endecott, Gerald D. Hanneman, and Paul W. Smith Jan. 1970 6 p refs
(AM-70-3) Avail: CFSTI

Chronic poisoning with the organophosphorus pesticide disulfoton at a dosage level of 10 ppm in the diet has been found to have an adverse effect on reproduction in rats. The primary effect is a reduction in the number of pregnancies and occurs equally in matings between poisoned males and control females and between control males and poisoned females. Reduction of cholinesterase activity is greater and symptoms of poisoning more severe in poisoned females. Brain cholinesterase activity is reduced in the offspring of poisoned females. Author

N70-34000# Oklahoma Univ., Oklahoma City. Dept. of Physiology and Biophysics.
QUANTITATIVE EVALUATION OF OPTICALLY INDUCED DISORIENTATION
M. Herbert Brecher and Gerhard A. Brecher FAA Jan. 1970 6 p refs
(Contract FA-67-AC-2699-1)
(AM-70-2) Avail: CFSTI

The purpose of this study was to establish quantitatively and systematically the association between the speed of movement of an optical environment and the extent of disorientation experienced by an individual viewing this environment. The degree of disorientation was determined by measuring the angle by which an individual deviates from a straight path when he walks back and forth within a rotating optokinetic drum. The correlation between

the speed of the moving optical environment and the amount of disorientation indicates that greater disorientation occurs when the optical environment moves faster. It appears that at faster movements of the optokinetic drum, the subjects become increasingly more cognizant of their disorientation and attempt to compensate for it. At velocities of less than 20 radians/min, most subjects are disoriented in their motor activity without being aware of it.
Author

N70-34021*# Hawaii Univ., Honolulu. Dept. of Botany.
ROLE OF GRAVITATIONAL STRESS IN LAND PLANT EVOLUTION: THE GRAVITATIONAL FACTOR IN LIGNIFICATION, PART 1 Semiannual Report
S. M. Siegel Jun. 1970 43 p refs *Its* Botan. Sci. Paper No. 15
(Grant NGR-012-001-053)
(NASA-CR-109873) Avail: CFSTI CSCL 06C

The role of silicon in the chemo-mechanical properties of plants is supported by this investigation which includes effects of silicate on plant growth and the toxicity of germanate and GeO2. Experiments proved that germanium does inhibit germination and later growth of barley and wheat and retards silicon metabolism. Shoot and root growth in oven crystals and vermiculite were reduced in the absence of silicon and the leaves showed wilting, withering, reduced chlorophyll, and necrotic spotting. It is concluded that only plants requiring silicon are sensitive to germanium and germanium inhibition can be reversed by additions of silicon.
E.M.C.

N70-34038# School of Aerospace Medicine, Brooks AFB, Tex.
WHOLE BODY IRRADIATION EFFECT RELATED TO CANINE TREADMILL PERFORMANCE DECREMENT AN ANNOTATED BIBLIOGRAPHY Final Report, Sep. 1969 - Feb. 1970
J. W. Watters, C. H. Bennett, and R. F. Hudson Apr. 1970 14 p refs
(AD-705976; SAM-TR-70-22) Avail: CFSTI CSCL 6/18

This bibliography was prepred from a search of the literature for the years 1958 through 1968 as part of a study to determine the effects of radiation on canine locomotion. The paper contains a compilation of 15 titles and abstracts on canine performance decrement following high doses of radiation. The following reference sources were used: Biological Abstracts, Excerpta Medica, Index Medicus, and Nuclear Science Abstracts.
Author (TAB)

N70-34070# National Center for Air Pollution Control, Durham, N.C.
HANDBOOK OF AIR POLLUTION
James P. Sheehy, William C. Achinger, and Regina A. Simon 1969 231 p refs
(PB-190247; PHS-PUB-999-AP-44) Avail: SOD $2.25 CSCL 13B

Individuals working in the air pollution field often need access to data concerning the characteristics and behavior of air, gases and particles, and the chemistry of atmosphere pollutants, and to data of a general nature such as mathematics and common conversion factors. At present, to have access to all this information, the individual needs a wide variety of reference books. The Air Pollution Handbook was designed to consolidate the applicable portions of these numerous references into a single, easily accessible source. The primary consideration for inclusion in the handbook is that the information be unlikely to change. This, then, excludes experimental results and data on air quality, even though these may be quite useful. The one exception to this general rule is the section on medical aspects. The experimental data that is included here is widely accepted in the field of biological experimentation.
Author (USGRDR)

N70-34074*# Translation Consultants, Ltd., Arlington, Va.
RELATIONSHIP BETWEEN THE RENIN-ANGIOTENSIN SYSTEM AND THE beta-ADRENERGIC RECEIVERS IN THE THIRST MECHANISM [RELACION ENTRE EL SISTEMA RENINA-ANGIOTENSINA Y LOS RECEPTORES beta-ADRENERGICOS EN EL MECANISMO DE LA SED]
L. A. Fernandez Washington NASA Aug. 1970 3 p Transl. into ENGLISH from Medicina (Argentina), v. 29, no. 6, 1969 p 435-436
(Contract NASw-2038)
(NASA-TT-F-13186) Avail: CFSTI CSCL 06C

Results of experiments on the effects of renin and angiotensin administrations on the thrist mechanisms of rats are reported. In one experiment the controls were left intact whereas the test animals were nephrectomized. In another experiment the test animals were kept under arterial hypertension. It is postulated, that the renin and angiotensin increase the ingestion of water, which is controlled by central renal factors. Other results are presented.
Author

N70-34086# National Air Pollution Control Administration, Arlington, Va.
AIR QUALITY CRITERIA FOR PHOTOCHEMICAL OXIDANTS
Mar. 1970 202 p refs
(PB-190262; NAPCA-Pub-AP-63) Avail: SOD $1.75; CFSTI (MF only) CSCL 13B

The document focuses on photochemical oxidants as they are found in the ambient air. The presence of photochemical oxidants in the ambient air is then considered in relation to: (1) effects on vegetation; (2) effects on materials; (3) toxicological studies of effects on animals and man; and (4) epidemological studies. The literature has been reviewed thoroughly for information related to the development of criteria, and the document not only summarizes the current scientific knowledge of photochemical air pollution, but also attempts to point up the major deficiencies in that knowledge and the presently recognized needs for further research.
Author (USGRDR)

N70-34199# Allied Research Associates, Inc., Concord, Mass.
BIBLIOGRAPHY ON BIOLOGICAL EFFECTS OF RADIO-FREQUENCY ELECTROMAGNETIC FIELDS (WITH SPECIAL ANALYTICAL AIDS), VOLUME 2 Final Report, 1 Aug. 1968 - 31 Jul. 1969
Janet Healer and Robert Smiley Dec. 1969 135 p refs
(Contract DADA17-69-C-9021)
(AD-704712; ARA-9G61-F-Vol-2) Avail: CFSTI CSCL 6/18

The report presents an extensive bibliography with special analytical aids for foreign and domestic journal articles, books, and reports dealing with the subject of biological effects of radio-frequency electromagnetic fields, particularly for microwave fields.
Author (TAB)

N70-34215# National Air Pollution Control Administration, Cincinnati, Ohio.
TOBACCO, A SENSITIVE MONITOR FOR PHOTOCHEMICAL AIR POLLUTION
Walter W. Heck, Frank L. Fox, C. Stafford Brandt, and John A. Dunning Jun. 1969 25 p refs
(PB-190257; AP-55) Avail: SOD $0.25; CFSTI CSCL 13B

The development of a technique by which the sensitive tobacco variety Bel W3 is used as a monitor for photochemical air pollution is discussed. The technique uses the plant as an indicator of the oxidant complex in both urban and rural areas. Two pilot studies that were conducted over a 3-year period during the development of the monitoring technique are included in the discussion. Attention is given to an explanation of the proper procedures for planting, transplanting, fertilizing, and caring for mature plants. The methods used in determining and recording injury to plant leaves is included; the studies showed almost daily injury to monitoring plants.
Author (USGRDR)

N70-34221# Joint Publications Research Service, Washington, D.C.
MATHEMATICAL MODEL OF SIMPLEST HYDROECOLOGICAL SYSTEM
V. V. Menshutkin et al. 18 Jun. 1970 10 p refs Transl. into ENGLISH from Gidrobiologicheskiy Zh. (Moscow), no. 2, 1970 p 28-35
(JPRS-50770) Avail: CFSTI

Mathematical models of hydroecological systems are presented. Mathematical modeling of populations of water animals and of whole ecological systems is a necessary and essential stage on the path toward solving the complex problem of managing natural water resources. Author

N70-34231*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A REVIEW OF THE BIOLOGICAL EFFECTS OF VERY LOW MAGNETIC FIELDS
Charles C. Conley Washington Aug. 1970 26 p refs
(NASA-TN-D-5902; A-3415) Avail: CFSTI CSCL 06S

The first studies of the effects upon living organisms of exposure to magnetic fields lower than that of the Earth were made within the present decade. In this review, ten of these are tabulated according to the taxonomic classification of the organism studied. Also included in the tabulation are eleven studies of the effects of fields in the geomagnetic range. Reports of studies of very low magnetic field effects were not found for fungi, echinoderms, amphibians or subhuman primates; specific studies of musculo-skeletal functions have not been reported, nor do ultrastructural techniques appear to have been applied to the study of very low magnetic field effects. A useful body of information should include such studies. Nonetheless, some well controlled experiments reviewed herein appear to have established that certain lower invertebrates, protozoans, and plants are indeed sensitive to the vector of the ambient magnetic field in the geomagnetic range, and that in nearly null magnetic fields, the growth, reproductive, aging, behavioral and phagocytic functions of some species are affected. Two studies of very low magnetic field effects are described in detail, these show a reduced cyto-enzyme synthesis rate in vivo in mice, but no reaction rate change in vitro. Author

N70-34244*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY A Continuing Bibliography with Indexes
Jun. 1970 140 p refs
(NASA-SP-7011(77)) Avail: CFSTI CSCL 06E

A continuing bibliography is presented which provides a convenient compilation of references for medical and biological scientists. The subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival life support systems, exobiology, and personnal factors receive appropriate attention. Author

N70-34316# National Air Pollution Control Administration, Arlington, Va.
AIR QUALITY CRITERIA FOR CARBON MONOXIDE
Mar. 1970 179 p refs
(PB-190261; NAPCA-Pub-AP-62) Avail: SOD $1.50 CSCL 13B

Carbon monoxide (CO) is focused on as it is found in the ambient air; therefore, literature on extremely high levels of CO was not extensively cited. The occurrence, properties, and fate of atmospheric CO and principles of formation and control are reviewed followed by a discussion of estimation of CO emissions and measurement of atmospheric CO. The effects of CO are considered in relation to vegetation, toxicological studies on animals and man, and epidemiological studies. The scientific literature was generally reviewed through March 1969, with additional sources for reports as recent as January 1970. The literature was reviewed thoroughly for information relatied to the development of criteria. The current scientific knowledge of CO air pollution and attempts to point up the major deficiencies in that knowledge and the presently recognized needs for further research are summarized. Author (USGRDR)

N70-34330# National Air Pollution Control Administration, Arlington, Va.
AIR POLLUTION TRANSLATIONS: A BIBLIOGRAPHY WITH ABSTRACTS, VOLUME 1
May 1969 173 p refs
(PB-190258; NAPCA-Pub-AP-56) Avail: SOD $1.75; CFSTI CSCL 13B

Contents: General; Emission sources; Atmospheric interaction; Measurement methods; Control methods; Effects human health; Effects plants and livestock; Effects materials; Effects economic; Air quality measurements; Legal and administative aspects; Standards and criteria; Basic science and technology; Author index; Language index; Subject index. USGRDR

N70-34401*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A STUDY OF ASEPTIC MAINTENANCE BY PRESSURIZATION
J. M. Staughton 1 Mar. 1968 69 p
(Contract NAS1-7166)
(NASA-CR-66548) Avail: CFSTI CSCL 06M

A theoretical analysis of the characteristics of gas flow through microscopic holes in thin membranes demonstrated that a pressure differential across a membrane separating two quiescent gas chambers should prevent migration of microorganisms through a single microscopic hole against that pressure gradient. Preliminary experimental verification of the theoretical analysis was obtained for holes ranging from 19 to 228 microns in diameter in .012 and .030 inch thick membranes of polypropylene and aluminum. Spores of Bacillus subtilis var. niger were presented by gravity to the hole from an aerosol above the membrane, and were captured in the event of passage through the hole on agar medium in a tube located directly below. Forty-nine tests with pressure differentials ranging from 0.25 inches to 5.0 inches of water resulted in total exclusion of microorganisms from the detection medium. However, experimental conditions producing turbulence or high flow rates in either the aerosol or detection chambers resulted in penetration of spores against pressure differentials of 0.5 and 5.0 inches of water by mechanisms not yet explained. No differences could be detected in the exclusion or penetration of microorganisms as a result of the variables involved. Author

N70-34518*# National Aeronautics and Space Administration, Washington, D.C.
THE PROBLEM OF THE DISTRIBUTION OF INTELLIGENT LIFE IN THE UNIVERSE
V. I. Serdobolskiy Aug. 1970 13 p refs Transl. into ENGLISH from the book 'Problema Rasprostraneniya Razumnoy Zhizni vo Vselennoy' Moscow, Nauka, 1968 p 145-154
(NASA-TT-F-13179) Avail: CFSTI CSCL 06C

The hypothesis of the existence of numerous civilizations in the universe is subjected to critical analysis. A discussion of the discrepancy between the extremely fast rate at which civilization develops on our planet and the lack of any signs of intelligent activity in the universe leads to the conclusion that the hypothesis according to which there exist numerous independently developing civilizations is at best doubtful. Author

N70-34552# National Air Pollution Control Administration, Washington, D.C.
AIR QUALITY CRITERIA FOR SULFUR OXIDES

Jan. 1969 186 p refs
(PB-190252; AP-50) Avail: SOD $1.50; CFSTI CSCL 13B

The document focuses on the sulfur oxides commonly found in the atmosphere-sulfur dioxide, sulfur trioxide, their acids, and the salts of their acids. Further, the document considers the effects of the sulfur oxides in conjunction with other pollutant classes, especially particulate matter, where important synergistic effects are observed. The chemical and physical characteristics of the sulfur oxides are reviewed and the various analytical methods for measuring them in the atmosphere are considered. Also discussed are the effects of the sulfur oxides on visibility, vegetation, and materials. The toxicological effects of sulfur oxides on animals and on man are considered. Author (USGRDR)

N70-34583# National Air Pollution Control Administration, Washington, D.C.
AIR QUALITY CRITERIA FOR PARTICULATE MATTER
Jan. 1969 219 p refs
(PB-190251; AP-49) Avail: SOD $1.75; CFSTI CSCL 13B

Air quality criteria are an expression of the scientific knowledge of the relationship between various concentrations of pollutants in the air and their adverse effects on man and his environment. They are issued to assist the States in developing air quality standards. Air quality criteria are descriptive; that is, they describe the effects that have been observed to occur when the ambient air level of a pollutant has reached or exceeded specific figures for a specific time period. In developing criteria, many factors have to be considered. The chemical and physical characteristics of the pollutants and the techniques available for measuring these characteristics must be considered, along with exposure time, relative humidity, and other conditions of the environment. The criteria must consider the contribution of all such variables to the effects of air pollution on human health, agriculture, materials, visibility, and climate. USGRDR

N70-34573# National Air Pollution Control Administration, Washington, D.C.
AIR QUALITY CRITERIA FOR HYDROCARBONS
Mar. 1970 118 p refs
(PB-190489) Avail: SOD $1.25 CSCL 13B

The document focuses on gas-phase hydrocarbons and certain of their oxidation products, particularly aldehydes, that are associated with the manifestations of photochemical air pollution. Particulate hydrocarbons, and more specifically polynuclear hydrocarbons, are not treated in the document. It is important to recognize that the criteria for hydrocarbons rest almost entirely on their role as precursors of other compounds formed in the atmospheric photochemical system and not upon the direct effects of the hydrocarbons themselves. The publication reviews the chemical and physical characteristics of hydrocarbons and their degradation products, especially aldehydes, and considers the basic analytical methods used for measuring the atmospheric content of these compounds. Author (USGRDR)

N70-34656*# National Aeronautics and Space Administration, Washington, D.C.
THE PERIODIC MOVEMENTS OF THE PRIMARY LEAVES OF CANAVALIA ENSIFORMIS [DE PERIODIEKE BEWEGINGEN VAN DE PRIMAIRE BLADEREN BIJ CANAVALIA ENSIFORMIS]
Gerrit Brouwer Aug. 1970 106 p refs Transl. into ENGLISH from Ph.D. Thesis, 1926 120 p
(NASA-TT-F-13089) Avail: CFSTI CSCL 06C

Periodic movements of the primary leaves of the jackbean (Canavalia ensiformis) are investigated. After a discussion of previous investigations in this field, personal investigations are described. Included in the experiments are tests involving normal curves, artificial and covered leaf blades, cut leaves, submerged leaves, and leaves with removed nodes, as well as tests employing differing periods of constant and alternating light and darkness. The hypothesis that an unknown factor in the atmosphere affects the nodes of plants, which induce turgor changes causing periodic movements in the leaves is presented and defended. Results of clinostat tests are examined, and main conclusions are summarized. Author

N70-34687# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
TO THE USAEC DIVISION OF BIOLOGY AND MEDICINE. VOLUME 2: PHYSICAL SCIENCES. PART 3: INSTRUMENTATION
B. P. Hildebrand Mar. 1970 16 p refs
(Contract AT(45-1)-1830)
(BNWL-1307-Vol-2-Pt-3) Avail: CFSTI

Experimental and computational studies of the X-ray-to-alpha ratios for plutonium isotopic mixtures are briefly outlined. The development of surface-contoured diodes for plutonium determination in wounds is discussed, and the development of a phoswich detector for the lung counting of plutonium is described. Also, the development of a surface-barrier detector for radon monitoring in small-animal exposure chambers is summarized. NSA

N70-34770# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PLUTONIUM INHALATION STUDIES A Series of Lectures Given in Japan in 1969 at the Invitation of the Japanese Atomic Energy Commission
W. J. Bair Feb. 1970 284 p refs Lectures presented at Chiba, Japan, 15 Feb. – 23 Mar. 1969
(Contract AT(45-1)-1830)
(BNWL-1221) Avail: CFSTI

Equipment and procedures used for Pu inhalation studies in beagle dogs are described. The dynamics of plutonium retention, distribution, and excretion following inhalation were determined by administering more than 200 beagles three plutonium compounds. Results were obtained in a series of tests clearly illustrating the important influence of chemical and physical properties of the inhaled plutonium aerosol dispersing throughout the body. Further experiments are also reviewed including: (1) particles of Pu(238)O2 as large as 50 micrometers dispersed in air and inhaled by beagles; (2) plutonium particles phagocytized rapidly in rats, about 60 minutes following inhalation or intraperitoneal injection of Pu(239)O2; and (3) the use of vivo counting for Pu-238, Pu-239, Pu-240, and Am-241 measurements. It was found that the inhaled plutonium in dogs was manifested principally in three tissues: lung, tracheobronchial lymph nodes, and circulating lymphocytes. J.A.M.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04, Biosciences.

N70-33480# Flying Personnel Research Committee, London (England).
THE BLUR ZONE
T. C. D. Whiteside (RAF Inst. of Aviation Med., Farnborough, Engl.) and G. D. Samuel Nov. 1969 7 p refs
(FPRC/1293) Avail: CFSTI

It is shown that if a dimensionless particle is moving through a three-dimensional field, the parts of the field which have a common angular velocity relative to the particle lie on the surface

of a toroid described about the particle. The practical implication to the low flying aviator is that the objects observed on the ground increase beyond a certain threshold of visibility or dynamic visual acuity whenever they enter into the toroid, whose projection on the ground causes zones of blurring in which the ground objects cannot be seen with sufficient clarity because they are moving past too quickly. Author

N70-33592# Flying Personnel Research Committee, London (England).
A STUDY OF THREE AIR VENTILATED GARMENTS USING CONVENTIONAL AND REVERSED FLOW AIR SUPPLIES
J. Morrison (RAF Inst. of Aviation Med., Farnborough, Engl.) Nov. 1969 13 p refs
(FPRC/Memo-249) Avail: CFSTI

Two flying clothing assemblies, the air ventilated suit Mk 2A, and the combined partial pressure, anti-G and AVS Mk 2P suit, were investigated with conventional and reversed flow air supplies using four subjects in a hot environment such that heat loss could only occur by evaporation of sweat. There is no significant difference in the oral temperatures, ear temperatures, heart rate and sweat losses of subjects when the two ventilating air supplies are at the same flow rate, temperature, and humidity. The air ventilated aircrew coverall was also investigated under similar conditions but it was not possible to produce adequate reversed air supplies because of collapse of the PVC ducting around the metal spacers. Author

N70-33627# Navy Experimental Diving Unit, Washington, D.C.
TABLES FOR CONVERTING OXYGEN PERCENTS TO PARTIAL PRESSURES
Robert Jenner and Robert Biersner Apr. 1970 58 p refs
(AD-706039; NEDU-RR-1-70) Avail: CFSTI CSCL 6/11

The report includes a set of tables to be used primarily by diving activities for rapid determination of oxygen partial pressures from known depths and oxygen percents. The procedures and computer techniques used to generate these tables are also described. Author (TAB)

N70-33662# Joint Publications Research Service, Washington, D.C.
TREATMENT OF WATER WITH POTASSIUM PERMANGANATE TO REMOVE TASTES AND ODORS
S. I. Dobrushina et al. *In its* Soviet Res. in Sanit. and Noise Meas. 11 Jun. 1970 p 6–10
Avail: CFSTI

Water treatment tests are examined using activated carbon and potassium permanganate to remove tastes and odors from water. A physiochemical analysis of the Desna River was completed, along with dosage determination of potassium permanganate. Test results show that KMn04 removed tastes and odors quite effectively and that it is economical in costs. J.A.M.

N70-33693# Sperry Gyroscope Co., Great Neck, N.Y.
RESEARCH IN VISUAL PERCEPTION FOR CARRIER LANDING. SUPPLEMENT 1, PART 2: RESPONSE MATRIX ANALYSIS BY COMPUTER Final Report, 1964 – 1969
Theodore Gold and Robert F. Perry Dec. 1969 427 p ref Prepared for Navy
(Contract Nonr-4061(00))
(AD-706038; SGD-5265-0327-Suppl-1-Pt-2) Avail: CFSTI CSCL 5/10

The supplement to Report No. SGD-5265-0327, AD-706 036, contains the printout data provided by the Univac 1108 high-speed, digital computer in the analyses of stimulus-response data using normal response distribution techniques. Both glide slope and aim point studies are included, and the data are described. Author (TAB)

N70-33777*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MANNED OPERATIONS FOR THE APOLLO LUNAR MODULE IN A SIMULATED SPACE ENVIRONMENT
O. L. Pearson and P. R. Gauthier (Boeing Co.) Washington Jun. 1970 34 p refs
(NASA-TN-D-5760; MSC-S-225) Avail: CFSTI CSCL 05I

A series of tests was conducted in a simulated space environment to confirm the satisfactory performance of the Apollo lunar module in a thermal vacuum environment and to verify crew operating procedures in a thermal vacuum environment. Because of mission simulation requirements, the spacecraft was manned only during specific time periods of the test. The crewmen were required to perform ingress/egress while in thermal vacuum conditions. The ingress/egress sequences were based on sequential transfer of the test crewmen from the chamber manlock to the chamber and then into the spacecraft by a stairway which was 13.5 feet high and at an angle of 63 deg with the horizontal. To perform the ingress/egress sequences safely, the following systems and equipment were developed and qualified: specialized gas-connector assemblies, restraint assemblies, gas and electrical umbilicals, and an open-loop environmental control system. The lunar module test article program presented the first large-scale test of the practical application of the extensive safety practices that were adopted by the National Aeronautics and Space Administration. The tests were successfully completed without compromising safety or delaying the planned Apollo launch schedule. Author

N70-33779*# Barry Wright Corp., Watertown, Mass.
INVESTIGATION OF THE VIBRATION ISOLATION OF COMMERCIAL JET TRANSPORT PILOTS DURING TURBULENT AIR PENETRATION
Dale W. Schubert, Jerome S. Pepi, and Frank E. Roman Washington NASA Jul. 1970 129 p refs
(Contract NAS1-8080)
(NASA-CR-1560) Avail: CFSTI CSCL 05E

The results of an analytical and experimental investigation of the configuration of an electrohydraulic pilot seat isolation system which would provide commercial jet transport pilots with maximum protection from the dynamic response of the aircraft during turbulent air penetration are presented. A literature survey was conducted into the effects of vibration on the visual and motor performance of seated human subjects (based on equal excitation of the subject and his controls) and the vibration levels encountered at the cockpit of present and future commercial jet transport aircraft during the penetration of turbulence. It was determined that active vibration isolation of the pilot was required in the vertical direction with a resonant frequency of nominally 2 Hz, a resonant transmissibility of less than 2, and better than 70 percent isolation at 4.5 Hz. Author

N70-33793*# Whirlpool Corp., St. Joseph, Mich. Life Support Systems Group.
INFLIGHT URINE VOLUME DETERMINATION Final Report
William Thomas 10 Apr. 1970 32 p refs
(Contract NAS9-10528)
(NASA-CR-108497) Avail: CFSTI CSCL 06P

The feasibility, functionality, and problem areas involved in using lithium and cesium as tracers for urine volume determinations are investigated. Experiments were performed to determine the presence of lithium or cesium in urine, and the possible interference of urine with the analysis of the tracers. The rates of dispersion of the tracer salts in urine, the possible retention of the tracer by the urine collection bag materials, and the overall accuracy and functionality of the method are also determined. E.M.C.

N70-33809# Embry-Riddle Aeronautical Inst., Daytona Beach, Fla.
DEVELOP AN OBJECTIVE FLIGHT TEST FOR THE

CERTIFICATION OF A PRIVATE PILOT Final Report, Jun. 1969 - Apr. 1970
Frank G. Forrest May 1970 135 p refs
(Contract DOT-FA-69-WA-2167)
(DS-70-17) Avail: Issuing Activity

An FAA test program is described which has a format similar to a computer program. The test program contains statements to guide the examiner in measuring performance of the applicant. Test items are designed to obtain data on the state of development of the applicant's aptitudes in retention-recall, judgment-planning-problem solving, perceptual-motor coordination, and habit as pertains to the function of an airplane pilot. These aspects of human behavior were selected because they appear to be the best criteria to determine the probability that the applicant, if awarded the private pilot certificate, would operate properly and safely. It is contemplated that the test will be computer scored. The test Form P was administered to a sample of 15 newly certified private pilots. Performance scores on the experimental test compared with subjective ratings given for the actual pilot certification test produced a Pearson product-moment correlation coefficient of .499. The sample profile revealed that lack of division of attention and collision avoidance procedural habits were the sample member's weakest areas. Judgment-planning-problem solving were their strongest. Author

N70-33835*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE FOOD TECHNOLOGY
1970 215 p refs Proc. of the Conf. held at St. Petersburg, Fla., 15-17 Apr. 1969
(NASA-SP-202) Avail: CFSTI CSCL 06H

Operational experience and advanced technological developments are combined in evaluating the problems in improving the nutritional aspects for future manned space missions. The initial Apollo feeding system is expanded to include spoon feeding, improved packaging and storage, and new food preparation methods and handling equipment. For individual titles, see N70-33836 through N70-33863.

N70-33836*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE APOLLO FOOD PROGRAM
Malcolm Smith *In its* Aerospace Food Technol. 1970 p 5-13 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Extensive changes are proposed for the initial Apollo food system since a number of deficiencies were apparent in the baseline food program that led to inadequate food consumption and metabolic imbalance in astronauts. Main improvements constitute: (1) reduced time and effort for meal preparation; (2) purification and better flavoring of the water for reconstituting dehydrated foods; (3) eradication of functional failures in rehydratable food packages; (4) more appealing systems of foods and packaging; and (5) reduction of in-flight illness and anorexia. Less emphasis should be placed upon dietary manipulation whereas systematic improvement of foods, packaging, and crew training should be undertaken to cater to the psychophysiology of eating. G.G.

N70-33837*# School of Aerospace Medicine, Brooks AFB, Tex.
MANNED ORBITING LABORATORY FEEDING SYSTEM REQUIREMENTS
Jerry L. Welbourn *In* NASA, Washington Aerospace Food Technol. 1970 p 15-19 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Discussed are feeding requirements for the manned orbiting laboratory by considering the particular type of mission, spacecraft design and engineering, and the restrictions imposed on the feeding system during space travel. Nutrient allowances for aerospace rations are developed from metabolic requirements for man under stress of space travel and are shown in table form; also prescribed are microbiological standards for the MOL feeding system assembly. Outlined are requirements for food packaging and safety. G.G.

N70-33838*# School of Aerospace Medicine, Brooks AFB, Tex.
QUANTIFYING AND IMPROVING MANNED ORBITING LABORATORY FOOD
Robert L. Flentge *In* NASA, Washington Aerospace Food Technol. 1970 p 21-29 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The objectives of this effort are to: (1) standardize the format and the content of all space-food documents; (2) establish realistic end-product requirements and quality assurance provisions, and (3) reflect technological improvements in food production documents. Also considered are human factors criteria, food stability in adverse environmental conditions, and nutritional compositions to arrive at an improved Mol feeding system. A list of 54 space food items is included. G.G.

N70-33839*# School of Aerospace Medicine, Brooks AFB, Tex.
EVALUATION OF SPACE FEEDING SYSTEMS
J. E. Vanderveen *In* NASA, Washington Aerospace Food Technol. 1970 p 31-38 refs (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The objectives of this evaluation were to identify any deficiencies in the expanded Gemini/Apollo systems, to perform a functional verification for 30 days, and to develop new criteria for future space feeding systems. The evaluation was divided into four areas: (1) life-support evaluation, which included studies of the nutritional value afforded by the food; (2) food acceptance and preference evaluation, which included the rating of individual foods, measurement of food consumption, and the psychological benefits provided; (3) systems interface, which included study of efficient use of weight and volume allowances, the reliability of systems components, the timeline production of metabolic, food, and packaging waste, and the potential for environmental contamination; and (4) human factors, which included simplicity, ease of handling, and safety. Author

N70-33840*# School of Aerospace Medicine, Brooks AFB, Tex.
DEVELOPMENT OF NEW CONCEPTS FOR THE FEEDING SYSTEM FOR THE USAF MANNED ORBITING LABORATORY
Frederic F. Doppelt *In* NASA, Washington Aerospace Food Technol. 1970 p 37-41 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

An improved prototype space food system was developed from the original Gemini/Apollo feeding system that allows for spoon feeding during 30 day MOL missions. Evaluation of the spoon feeding concept during zero-G flight test runs confirmed the feasibility of this method and the system was successfully incorporated into wetpack dinners on Apollo 8 and Apollo 9. A complete systems engineering analysis led to redesign of the MOL feeding system and incorporation of spoon feeding methods besides several other improvements in packaging, time minimization, waste storage, etc. G.G.

N70-33841*# Whirlpool Corp., St. Joseph, Mich.
SYSTEMS ANALYSIS OF MANNED ORBITING LABORATORY FEEDING SYSTEM
Norman G. Roth *In* NASA, Washington Aerospace Food Technol. 1970 p 43-55 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Presented is the systems analysis approach that led to an improvement in the overall feeding system for the Manned Orbital Laboratory Program. Packaging and food-shape inefficiencies in the MOL baseline system were eliminated and an interface chart for a typical rehydratable food package and its constraints developed. This chart was then utilized to evaluate the nutritional

and dietic aspects of the food as well as the optimum utilization of the available stowage place. G.G.

N70-33842*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO APPLICATIONS PROGRAM REQUIREMENTS
Paul C. Rambaut *In its* Aerospace Food Technol. 1970 p 57–60 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The requirements for the AAP feeding system are effected by its two primary objectives of: (1) the experiment on habitability; and (2) medical data collection. The food must be sufficiently well defined so that nutrient intake can be derived from minimal inflight data recorded during the experiment. Food flavor, texture, appearance, and packaging will be designed so that complete consumption is obtained because this is the governing criterion for the nutritional and experimental requirements of the AAP flight feeding system. G.G.

N70-33843*# Naval Medical Research Lab., New London, Conn. Submarine Medical Research Lab.
OPERATIONAL-EXPERIENCE FOOD SERVICE ON NUCLEAR SUBMARINES
J. D. Bloom *In* NASA, Washington Aerospace Food Technol. 1970 p 63 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Guidelines provide the Navy with recipe service, the use of ration dense foods is encouraged. Particular attention is given to sanitary food preparation to prevent prolonged standing of creamed items and to assure sufficient core cooking of poultry to eliminate bacterial contamination. Refrigeration facilities utilize neon since leaks of refrigerants are potential sources of halogenated hydrocarbon air contamination in enclosed environments. G.G.

N70-33844*# Naval Medical Research Lab., New London, Conn. Submarine Medical Research Lab.
PSYCHOLOGICAL EFFECTS OF SUBSTANTIAL AND APPETIZING MENUS FOR SUBMARINE PERSONNEL
Charles F. Gell *In* NASA, Washington Aerospace Food Technol. 1970 p 65–71 refs (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Psychological studies on eating habits and diets of submarine personnel establish the importance of supplying abundant and appetizing food on prolonged cruises. Critical attitudes can arise if the food degenerates from its quality. Ingestion of food aboard a submarine does not pose any problems if between meal snacking remains normal. It is concluded that until NASA is capable of engineering a rotating spaceship which can provide moderate G loading in its outer periphery, feeding in space will be satisfactory because of the disadvantages that the weightless state imposes on the eating process for the astronauts. G.G.

N70-33845*# General Electric Co., Philadelphia, Pa.
TEKTITE 1 FOOD DEVELOPMENTS
R. W. Scarlata *In* NASA, Washington Aerospace Food Technol. 1970 p 73–77 refs (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The food selection and preparation are described briefly. Pressure cooking was eliminated because of complexity of the fixture. Frying food was eliminated because animal fats break down into CO and acrolein. The food selected included TV dinners and other frozen food, canned food, and some fresh and freshly cooked food sent down by the dumb waiter. Pre-prepared meals were considered poor; individually prepared meals were good. If Tektite were redesigned, the following changes would be recommended: add a fast potato baker, toaster, and waffle iron; develop recipes designed to turn canned and frozen foods into more appetizing meals; monitor the temperature of food shipments better; and provide a food expert to develop a food subsystem. It was also noted that eating was the major entertainment. N.E.N.

N70-33846*# Navy Subsistence Office, Washington, D.C.
FOOD PLANS FOR SEALAB 3
Louella C. Peterson *In* NASA, Washington Aerospace Food Technol. 1970 p 79–85 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The food selection and preparation problems and plans are described. Freeze-dehydrated entrees were considered good from the standpoints of taste, stowage, stability, and preparation but were rejected because of the small piece size and similarity in appearance. The helium atmosphere ruled out fresh egg cookery and microwave ovens. Infrared ovens are used to heat frozen foods. Frankfurters, cooked ham, frozen fried chicken, and frozen hamburger heated in buns were investigated as changes from a frozen meat-in-gravy monotony. A 6-day menu cycle was planned, and fresh bread, pretrimmed fresh produce will be furnished every 4 days. N.E.N.

N70-33847*# Army Natick Labs., Mass.
ADVANTAGES, PROBLEMS, AND EXPERIENCES OF IRRADIATED FOODS
Edward S. Josephson *In* NASA, Washington Aerospace Food Technol. 1970 p 87–100 refs (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Irradiation as a means of food preservation is discussed. Among the advantages mentioned are the following: spoilage organisms and pathogens are killed; sprouting in tubers is disrupted; shelf life of meats, vegetables and fruits is increased; food undergoes minimal changes in texture, flavor, odor, and color; and foods retain nutritive value. The main problem area is identified as proof of wholesomeness convincing to health authorities, and packaging is considered a lesser problem. It is felt that irradiated foods will become commonplace because of their generally excellent quality. N.E.N.

N70-33848*# Cornell Univ., Ithaca, N.Y.
AIRLINE VERSUS SPACE FEEDING
Paul A. Buck *In* NASA, Washington Aerospace Food Technol. 1970 p 105–108 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Ideas for space feeding by comparing airline and aerospace feeding systems are introduced. Use of the metric system to divide the astronaut's day, primarily in relation to his eating schedule, is discussed. Author

N70-33849*# Pan American World Airways, Inc., New York.
PAN AMERICAN WORLD AIRWAYS: PRESENT AND FUTURE PLANS
J. P. Treadwell *In* NASA, Washington Aerospace Food Technol. 1970 p 109–111 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The logistics of feeding passengers in the 707 and 747 aircraft are described. The problems of weight, space, and disposability are outlined. Food variety, demand food service, and ease of preparation are also mentioned. N.E.N.

N70-33850*# Japan Air Lines Co., Ltd., Tokyo.
JAPAN AIR LINES: PRESENT AND FUTURE PLANS
Toshimitsu Ikegami *In* NASA, Washington Aerospace Food Technol. 1970 p 112–114 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The primary motivating force behind the food planning service is identified as a taste of food of the native land. The problem of serving food to passengers from all parts of the world is discussed, and the modifications taken in attempting to please the various palates or to give a choice are mentioned. N.E.N.

N70-33851*# Pillsbury Mills, Inc., Minneapolis, Minn.
FOOD DEVELOPMENT AND EXPERIENCES
Robert M. Weiss *In* NASA, Washington Aerospace Food Technol. 1970 p 117–119 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Research in developing compressed food is described. Food bars were made in a variety of flavors, from hard brittle to soft plastic and from smooth to chunky texture, in fruit, vegetable, meat-analog, and confection areas. The bars can have up to 5.75 Kcal/g, retain vitamin viability, and are low cost and stable. Protein-encapsulated vegetable oil serves as a base for the food. Work in developing primate pellets to be dispensed from a mechanical feeder is also mentioned. N.E.N.

N70-33852*# Swift and Co., Chicago, Ill.
MEAT-TYPE-FOOD DEVELOPMENT AND EXPERIENCES
R. L. Pavey *In* NASA, Washington Aerospace Food Technol. p 121–123 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The problems arising from the variabilities of fat, water, and nutritional contents in meats are described, and the development of bite size pieces of meat and sandwiches is discussed. Bite size pieces are cut from a frozen, moulded bar. A process for producing textured beef and chicken which provides a binding characteristic to reduce shredding is mentioned. Areas for improving space flight food are identified as increasing spice levels, spoon and bowl feeding, and using intermediate moisture or moisture mimetic agent foods. N.E.N.

N70-33853*# General Foods Corp., White Plains, N.Y.
GENERAL FOODS CORPORATION PRODUCT DEVELOPMENT AS RELATED TO AEROSPACE FOOD PROBLEMS
Ben F. Buchanan *In* NASA, Washington Aerospace Food Technol. 1970 p 125–129 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Developments in shelf-stable processed foods are described. Recent trends in rehydrable foods, intermediate moisture products, and moisture mimetic products are discussed. Additives which simulate moistness are listed, and an emulsion formulation is given for introducing the mimetic composition into compressed or freeze dehydrated good bars. It was found that the acceptability of dehydrated food was increased by the addition of moisture mimetic foods. N.E.N.

N70-33854*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FOOD SYNTHESIS BY PHYSICOCHEMICAL METHODS
Jacob Shapira *In its* Aerospace Food Technol. 1970 p 133–140 refs (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The selection of pure nutrients and synthesis of foods for a manned planetary space flight are discussed. The composition of diets and the catabolism of food are given. The syntheses of formaldehyde from carbon dioxide and hydrogen, of glycerol from formaldehyde, and of formose sugars from formaldehyde are outlined. N.E.N.

N70-33855*# California Univ., Berkeley.
BIOLOGICAL FOODS
Doris Howes Calloway *In* NASA, Washington Aerospace Food Technol. 1970 p 141–144 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The composition of biomasses is discussed with respect to their usefulness as food in spacecraft. The problem requires determination of the relationship between the composition of the product and the nutritional needs of the crew, and also detection of the presence of substances that have no nutritional value, but that do have physiological effects. Studies show that consumption of crude biomasses is limited to the function of providing protein to accompany a chemically regenerated or onboard diet high in fat or carbohydrate. R.B.

N70-33856*# Technology, Inc., Dayton, Ohio.
LONG-TERM SPACE MISSION REQUIREMENTS
Clayton S. Huber *In* NASA, Washington Aerospace Food Technol. 1970 p 145–149 refs (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The possibilities of long-term space missions beyond the Apollo Applications Program are discussed. It is noted that no definite programs have been implemented, although considerable effort has been expended during initial planning stages. Three concepts of space exploration, including earth orbit, lunar, and planetary programs, are discussed individually. Possible feeding systems for each type of mission are considered. R.B.

N70-33857*# Army Natick Labs., Mass.
US ARMY FOOD RESEARCH AND DEVELOPMENT PROGRAM
Herbert A. Hollender *In* NASA, Washington Aerospace Food Technol. 1970 p 151–163 (See N70-33835 18-05) refs
Avail: CFSTI

Different techniques of preserving food for military rations are discussed. The methods include freeze-drying and flex canning. Reconstitution techniques developed for space flight foods were applied to developing suitable rations for field use. R.B.

N70-33858*# Giessen Univ. (West Germany).
WERNER SELL EQUIPMENT DEVELOPMENT
Werner Sell *In* NASA, Washington Aerospace Food Technol. 1970 p 169–170 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

A high temperature oven with fast-circulated hot air is described. The oven is compact and reduces thawing and cooking time compared to regular ovens, and is proposed as suitable equipment for spacecraft. R.B.

N70-33859*# Litton Systems, Inc., Minneapolis, Minn. Atherton Div.
AIRBORNE MICROWAVE OVEN DEVELOPMENT
Calvin Hagberg and David Graff *In* NASA, Washington Aerospace Food Technol. 1970 p 171–174 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The techniques of preparing food with microwave ovens are discussed. The background of microwave ovens developed for use in aircraft is examined and the current state of the art is presented. R.B.

N70-33860*# Raytheon Co., Lexington, Mass.
DESIGN CONSIDERATIONS FOR MICROWAVE HEATING OF SPACE FOOD
William Stone *In* NASA, Washington Aerospace Food Technol. 1970 p 175–176 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Reliability, weight, and size, as well as power supplies, are discussed as prime requirements in designing microwave heating units for food preparation in spacecraft. It is concluded that a light-weight unit suitable for spacecraft is within current industrial capabilities. R.B.

N70-33861*# Minnesota Mining and Mfg. Co., St. Paul, Minn.
INTEGRAL HEATING EQUIPMENT DEVELOPMENT
John M. Mahlum *In* NASA, Washington Aerospace Food Technol. 1970 p 177–181 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

Laboratory and performance tests of integral heating units are reported. The heating is accomplished from a resistive coating

applied to a surface area, and heat is delivered directly to the food being prepared with better than 90% efficiency. The various components of the heating unit are described and possible applications are discussed. R.B.

N70-33862*# Boeing Co., Seattle, Wash.
BOEING 747 LOWER LOBE GALLEY SYSTEM INTEGRATION
C. V. Lindow *In* NASA, Washington Aerospace Food Technol. 1970 p 183-191 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The Boeing 747 lower lobe galley and its function to store prepared meals and beverages and to enable trained personnel to present them to passengers are discussed. Diagrams are given to illustrate how the system is integrated and the advantages and disadvantages of the system to the airline are cited. R.B.

N70-33863*# Lockheed-California Co., Burbank.
FOOD SYSTEM INTEGRATION RESPONSIBILITIES OF AIRFRAME MANUFACTURERS
L. W. King *In* NASA, Washington Aerospace Food Technol. 1970 p 193-202 (See N70-33835 18-05)
Avail: CFSTI CSCL 06H

The design of a galley system and its integration into the aircraft are discussed with respect to the joint responsibility of the airframe manufacturer and the air carrier. The design characteristics include defining the objectives of the system, developing equipment performance and aircraft support requirements, describing the elements of the airborne system, and specifying the details of the interface between the aircraft and the ground equipment and facilities. The galley system of the Lockheed L-1011 is given as an example. R.B.

N70-33907*# Baylor Univ., Houston, Tex. Coll. of Medicine.
DEVELOPMENT OF A PROTOTYPE ONBOARD EEG ANALYSIS SYSTEM
James D. Frost, Jr. 30 Apr. 1970 147 p refs
(Contract NAS9-9418)
(NASA-CR-108508) Avail: CFSTI CSCL 06B

Details are presented on the design and preliminary operational tests of a laboratory prototype system for acquisition and automatic analysis of electroencephalographic and electro-oculographic signals. The system also provides an output display indicative of the subject's level of consciousness. The components are described, and results from tests on crew members of Tektite 1 and the submersible vehicle Ben Franklin are discussed. The effects of simulated spacecraft noise on sleep were studied, and it was felt that the noise did not cause a significant disruption of sleep. Alpha wavelength analyses are also mentioned. N.E.N.

N70-33943# Sperry Rand Corp., Great Neck, N.Y. Gyroscope Div.
RESEARCH IN VISUAL PERCEPTION FOR CARRIER LANDING. SUPPLEMENT 1, PART 1: RESPONSE MATRIX ANALYSIS BY COMPUTER Final Report, 1964 - 1969
Theodore Gold and Robert F. Perry Dec. 1969 354 p
(Contract Nonr-4081(00))
(AD-706037; SGD-5265-0327-Suppl-1-Pt-1) Avail: CFSTI CSCL 5/10

The supplement to Report No. SGD-5265-0327, AD-706 036 contains the printout data provided by the Univac 1108 high-speed digital computer in the analyses of the stimulus-response matrices involving correlation techniques. The printouts include both raw and reduced data and should be useful for future reference. Author (TAB)

N70-33948# Pennsylvania Univ., Philadelphia. Office of Engineering Research.
AN INTERACTIVE EXPERIMENT IN CHEMICAL SUBSTRUCTURE SEARCH USING THE MCC TOPOLOGICAL SCREEN SYSTEM
Richard Haber and David Lefkovitz Nov. 1969 55 p refs
(Contract NSF C-547)
(PB-189470) Avail: CFSTI CSCL 05B

A particular kind of real time interaction that can take place between a chemist and a computer based chemical substructure search system is discussed. The system is basically capable of retrieving structures as registry number references in response to a set of fragments expressed in Boolean (logical) relationships. Beyond this, however, the system can enter into a stylized dialogue with the chemist in which fragments that may indicate close structural relationships to those in the original inquiry are displayed, whereupon he has the opportunity to examine and select those that may expand upon or modify his original inquiry. Author (USGRDR)

N70-33971# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
EFFECTS OF VARYING LEVELS OF AUTOPILOT ASSISTANCE AND WORKLOAD ON PILOT PERFORMANCE IN THE HELICOPTER FORMATION FLIGHT MODE Final Technical Report, Dec. 1967 - Apr. 1968
Paul A. Anderson and Myrna L. Toivanen Mar. 1970 244 p refs
(Contract N00014-66-C-0362)
(AD-706001; Rept-12543-FR4; JANAIR-680610) Avail: CFSTI CSCL 5/5

The objective of the study was to evaluate pilot performance in manual IFR formation flight with varying levels of autopilot assistance and pilot workload. The study was conducted for a conventional helicopter, i.e., the UH-1 Iroquois, and an advanced vehicle, the AH-56 Cheyenne. Man-in-the-loop simulations of these vehicles were conducted to evaluate pilot performance under six levels of autopilot assistance, ranging in sophistication from the free vehicle to outer loop hold modes in heading and altitude, and under three levels of pilot workload, consisting of a forced-pace secondary concomitant task. Results of the study, within the constraints imposed by the simulation, indicated that increasing the level of autopilot assistance resulted in a less demanding task for the pilot and provided greater system stability. This was borne out in terms of both quantitative performance data and pilot opinion. However, position errors were not consistently reduced beyond the levels obtained during manual flight control modes where the highly quickened display was used. Only at the highest workload level tested did autopilot assistance serve to reduce the position errors from what was experienced under the manual control conditions. Author (TAB)

N70-33986*# J & J Marine Diving Co., Inc., Pasadena, Tex.
PREDICTING THE POSSIBILITY OF DECOMPRESSION SICKNESS, OR BENDS, IN MANNED ORBITAL FLIGHTS
Peter O. Edel 10 May 1968 33 p refs
(NASA Order T-72681; NASA Order T-74400)
(NASA-CR-108446) Avail: CFSTI CSCL 06S

Astronauts undergoing decompression to orbital cabin pressure are subjected to the dissolution of gases from their bodily tissues in proportion to the decrease in partial pressure of these gases, thus incurring the possible consequence of decompression sickness. In calculating a safe level of supersaturation of inert gas--in this instance, nitrogen--in the bodily tissue, techniques used in diving table computations were adapted for use in similar computations of pressure changes occurring in orbital flight. From these computations, the following hypothesis was developed: in order to prevent the occurrence of bends in orbital flight, the ratio of nitrogen partial pressure (within those bodily tissues having the slowest elimination rate) to the ambient pressure should not exceed 1.5:1. Graphs are herein submitted that predict a safe decompression rate according to the degree of nitrogen elimination that has been achieved. Author

N70-33987*# J & J Marine Diving Co., Inc., Pasadena, Tex. Research Dept.
DECOMPRESSION RISKS IN SUCCESSIVE HYPERBARIC-HYPOBARIC EXPOSURES
Peter O. Edel 28 Mar. 1969 34 p refs
(NASA Order T-77650)
(NASA-CR-108445) Avail: CFSTI CSCL 06S

As part of their training program, astronauts are required to carry out no-decompression dives at the bottom of a tank filled with 40 feet fresh water at the Marshall Space Flight Center while wearing pressure suits inflated to 3.5 psi above ambient pressure. These dives may be repeated twice daily for approximately five consecutive days. According to accepted techniques for calculating decompression tables, a diving schedule of two hours in the morning and two hours in the afternoon separated by a three hour surface interval does not incur a significant probability of decompression sickness. A similar work schedule can be safely followed on the second and successive days if a minimum surface interval of 16 hours separates the workdays. Calculations further indicate that these astronauts could safely fly home without incurring decompression sickness if the maximum aircraft cabin pressure is maintained at the equivalent of 10,000 feet altitude, with a given diving profile schedule which is suggested. Author

N70-34036# National Air Pollution Control Administration, Arlington, Va.
CONTROL TECHNIQUES FOR HYDROCARBON AND ORGANIC SOLVENT EMISSIONS FROM STATIONARY SOURCES
Mar. 1970 114 p refs
(PB-190266; NAPCA-Pub-AP-68) Avail: SOD $1.00 CSCL 13B

The effects of hydrocarbon and organic solvent emissions are of two types, direct and indirect. Direct effects are caused by the original, unaltered emissions, and indirect effects are caused by substances formed by photochemical reactions of the original emissions with other substances in the atmosphere. Information is presented on techniques for the control of organic emissions from stationary sources. Sources of hydrocarbon emissions include petroleum refining, gasoline distribution and marketing, chemical manufacturing, coal coking, fuel burning, waste disposal, and food processing. Sources of organic solvent emissions include manufacture and application of protective coatings, manufacture of rubber and plastic products, degreasing and cleaning of metal parts, dry cleaning operations, printing, and manufacture of chemicals. USGRDR

N70-34043# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RECOGNITION SYSTEMS WITH AN INFINITE PLANE RETINA
A. Kh. Gelig 19 Mar. 1970 24 p refs Transl. into ENGLISH from Vychislitelnaya Tekhn. i Vopr. Programmirovaniya (USSR), v. 7, no. 5, 1968 p 80–94
(AD-705750; FTD-MT-24-456-69) Avail: CFSTI CSCL 6/4

The learning recognition system proposed by V. A. Yakubovich is analyzed. It is shown how the elements and the instruction sequence must be organized so that learning algorithms are simplified. TAB

N70-34056# National Air Pollution Control Administration, Arlington, Va.
CONTROL TECHNIQUES FOR NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES
Mar. 1970 115 p refs
(PB-190265; NAPCA-Pub-AP-67) Avail: SOD $1.00 CSCL 13B

The role of nitrogen oxides in air pollution is reviewed. A discussion is presented on combustion control techniques to remove nitrogen oxides from exhaust gases. Also reported are the various methods to remove nitrogen oxides from industrial waste gases. USGRDR

N70-34066*# Univ. of Southern Calif., Los Angeles. Dept. of Physiology.
A LOW POWER BLOOD FLOW TRANSMITTER. TRANSMISSION OF CARDIOVASCULAR RESPONSE TO WEIGHTLESSNESS Progress Report, 1 Mar. – 31 May 1970
John P. Meehan, R. Rader, J. Henriksen, and L. Casados 15 Jun. 1970 20 p
(Contract NSR-05-018-087)
(NASA-CR-109872) Avail: CFSTI CSCL 06B

Pressures, flows, and dimensions characterize cardiovascular dynamics. An implantable system sensing these three parameters was designed for use on the Apollo Applications Program to determine cardiovascular responses of sub-human primates to long term weightlessness. Continuing research on the system is reported. Major efforts were directed toward evaluating and testing blood flow circuitry. A dog was implanted to evaluate the flow probe and circuitry. The flow probe was implanted on the terminal aorta and allowed to heal for several days; then the connector was exposed and connected to an external instrument package. In addition, an implantable unit for use on a large primate was fabricated and readied for implant. A systems description of the instrumentation is presented which includes a complete analysis of the approach. D.L.G.

N70-34086# Texas Technological Univ., Lubbock. Center of Biotechnology, Fatigue, and Human Performance.
PERFORMANCE, RECOVERY, AND MAN-MACHINE EFFECTIVENESS Semiannual Progress Report, 1 Sep. 1969 – 28 Feb. 1970
Richard A. Dudek 6 Apr. 1970 27 p
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-705467) Avail: CFSTI CSCL 5/10

The purpose of the program is the generation of basic data concerning human performance and recovery within several work systems settings under conditions of varied environments, task demands motivational levels, and nutritional factors. Further to generate from this basic data the solution to real problems and recommended procedures for mans operation under varying conditions of the work system, e.g., work-facilitating period combinations for various task types, durations of tasks, environments, etc., determination of mans ability to participate in continuous military operations, procedures, and methods for improved team operations, optimal work-rest schedules for crews of vehicles creating a vibrational environment, etc. Author (TAB)

N70-34189*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EVALUATION OF THE CREW: COMMAND MODULE POSTLANDING INTERFACE
Harold J. Clancey 7 Jul. 1969 35 p refs Program Apollo Working Paper No. 1348
(NASA-TM-X-64318) Avail: CFSTI CSCL 05H

Three separate test series were used to evaluate the postlanding interface between the crew and the command module: (1 postlanding-systems qualification tests, (2) water-egress-procedures developmental tests, and (3) flight-crew water-egress training. These tests permitted investigation of all crew and command module postlanding-interface areas which included systems, crew equipment, storage, and egress. Crew capability to detect upsetting system failures and in most cases, to take remedial action was demonstrated. Crew reposition, to effect a spacecraft upsetting, was shown to be safe and effective. Further testing is indicated to determine the reasons for upsetting compressor noise-level changes and to determine the desirability of maintaining only the lower noise level during upsetting for reasons of crew comfort. Author

N70-34195*# General Electric Co., Philadelphia, Pa.
ASTRONAUT ZERO GRAVITY PERFORMANCE EVALUATION PROGRAM. VOLUME 1: SUMMARY

TECHNICAL REPORT Final Study Report
[1969] 93 p refs
(Contract NAS9-8640)
(NASA-CR-108569) Avail: CFSTI CSCL 05E

The program encompassed: (1) The definition and preliminary design of experiment M508 (EVA and IVA hardware evaluation, concerned with astronaut worksite performance evaluation). (2) The construction of two prototype models of the M508 task panel to verify design concepts, develop manufacturing procedures, and collect simulated astronaut worksite performance data. (3) The conduct of experiment M508 using various ground based zero-gravity simulation modes. (4) The collection of additional data on man's force emission capability to establish 1-g and zero-g baselines. (5) The preparation and publication of a handbook of human engineering design data for reduced gravity conditions. The experimental program involved an evaluation of the major facets of astronaut performance while restricted to a limited worksite area. The program involved evaluation of the efforts required to install and enter different restraint concepts, remove panels and covers associated with gaining access to a work area, performance of specific tasks designed to evaluate the interactions between basic psychomotor behaviors, and the parameters of the EVA/IVA, zero-gravity environment and equipment. Author

N70-34220# Joint Publications Research Service, Washington, D.C.
ENGINEERING PSYCHOLOGY AND CONTROL SYSTEMS
O. A. Konopkin 29 Jun. 1970 6 p Transl. into ENGLISH from Vopr. Psikhologii (Moscow), no. 1, 5 Jan. 1970 p 131–134
(JPRS-50843) Avail: CFSTI

Engineering psychology and the importance of psychophysiological characteristics of the human operator are discussed. In designing operator stations, attention is often focused only on some anthropological data, individual characteristics of the functioning of the sense organs, and general artistic requirements for the designing of equipment and interiors. The value of individual engineering-psychological measures is often diminished by the fact that they are not always executed in the best way possible because they are not based on a serious psychological analysis of the operator's total activity in a given control system. Author

N70-34232# Army Medical Research Lab., Fort Knox, Ky. Experimental Psychology Div.
PROBABILITY GATE STATISTICS Progress Report
James N. Cronholm 3 Feb. 1970 9 p ref
(AD-705556; USAMRL-847) Avail: CFSTI CSCL 5/10

A probability gate presents a fixed but controllable transmission probability p to pulses arriving at its input. This report describes some statistical properties of the transformation imposed by a gate on the input distribution of interpulse intervals. The output distribution of interpulse intervals is derived in terms of the input density and p. A simple relation is shown to hold between the moment generating functions, and the first four output moments are derived in terms of the input moments and p. Certain restrictions on the kinds of obtainable output distributions are discussed. In particular, a condition is established which specifies when the output density is a replica of the input distribution. Author (TAB)

N70-34256# California Univ., Los Angeles.
ELECTROENCEPHALOGRAPHIC AND OTHER PHYSIOLOGICAL INDICATORS OF SHORT TERM STRESS Final Technical Report
W. Ross Adey and Jan Berkhout 11 May 1970 16 p refs
(Contract N00014-69-A-0200-4020)
(AD-705615) Avail: CFSTI CSCL 5/10

A study was undertaken to analyze the relationship of EEG data from the point of view of detecting stress, associated with interrogation, directly from patterning of EEG parameters, and to re-evaluate previously described findings where heart rate and pulse volume alterations coincided with question presentation during actual interrogations. TAB

N70-34288# School of Aerospace Medicine, Brooks AFB, Tex.
MANUFACTURING REQUIREMENTS OF FOOD FOR AEROSPACE FEEDING
Robert L. Flentge and Ronald L. Bustead May 1970 239 p refs
(AD-705603; SAM-TR-70-23) Avail: CFSTI CSCL 6/8

Manufacturing requirement documents were written which describe the food processing and packaging technology used in space feeding systems. These documents combine information contained in the original Space Food Prototype Production Guides with additions and modifications developed through food testing and manufacturing experience. They were designed to provide complete and systematic descriptions concerning the production environment, equipment, raw ingredients, processing and packaging procedures, and end item specifications used in the manufacture of space foods. These documents include cross references to microbiological requirements, food prototypes, quality assurance provisions and food coatings and coating methods. The use of these manufacturing requirement documents in space food production has essentially eliminated a requirement for granting specifications waivers for flight foods. Author (TAB)

N70-34301# National Air Pollution Control Administration, Arlington, Va.
CONTROL TECHNIQUES FOR CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES
Mar. 1970 72 p refs
(AD-190263; NAPCA-Pub-AP-65) Avail: SOD $0.70 CSCL 13/2

The document was prepared to summarize current information on sources of carbon monoxide (CO) emissions, methods of control, and costs and cost-effectiveness of controls. The control techniques described represent a broad spectrum of information from many engineering and other technical fields. The devices, methods, and principles were developed and used over many years, and much experience was gained in their application. They are recommended as the techniques generally applicable to the broad range of CO emission control problems. Many agricultural, commercial, industrial, and municipal processes and activities that generate CO are described individually. Author (USGRDR)

N70-34303# National Air Pollution Control Administration, Arlington, Va.
CONTROL TECHNIQUES FOR CARBON MONOXIDE, NITROGEN OXIDE, AND HYDROCARBON EMISSIONS FROM MOBILE SOURCES
Mar. 1970 132 p refs
(PB-190264; NAPCA-Pub-AP-66) Avail: SOD $1.25 CSCL 13/2

The predominant source of carbon monoxide (CO), nitrogen oxide (NO sub x), and hydrocarbon (HC) from mobile combustion sources is the exhaust gas from gasoline-fueled engines. The principal mobile sources that generate CO, NO sub x, and HC emissions are described individually. Various techniques to control such emissions from these sources are reviewed. Technical considerations of the more prominent and feasible design modifications, alternative power sources, fuel modifications, auxiliary devices, and alternative transportation modes are presented. Sections on source evaluation, equipment costs, cost effectiveness analysis, and current research and development also are included. Pertinent references are presented at the end of each section. Author (USGRDR)

N70-34327*# Little (Arthur D.), Inc., Cambridge, Mass.
STUDY OF LONG TERM ATMOSPHERIC TRACE CONTAMINANT MONITORING AND CONTROL Final Report
Philip L. Levins and James E. Oberholtzer 24 May 1970 91 p refs

(Contract NAS9-10434)
(NASA-CR-108507; C-72206) Avail: CFSTI CSCL 06K

This report describes the findings and recommendations resulting from a study of a baseline environmental/thermal control and life support subsystem for controlling trace contaminants in a spacecraft atmosphere. Instruments and techniques for measuring the atmospheric trace contaminants are surveyed, and improved methods of presenting contaminant monitor information to the crew are considered. Author

N70-34349*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MISSION TRAINING PROGRAM FOR THE FOURTH MANNED APOLLO MISSION
Robert C. Kohler 15 Feb. 1969 56 p refs
(NASA-TM-X-64320; MSC-CF-D-69-17) Avail: CFSTI CSCL 05I

The training program developed in this document is specifically tailored for the recycle of the Apollo 7 Back-up Crew. Approximately 1000 hours of training are planned and with judicious usage of the allocated time of seven months the training requirements can be fulfilled. The time available for training prior to launch necessitates a degree of specialization heretofore not an important factor. With minimal previous lunar module experience, the Crew Commander and the Lunar Module pilot shall concentrate most of their efforts towards attaining proficiency in all aspects of Lunar Module activity. Conversely, the Command Module pilot shall develop his skills in the Command Module, assuming primary flight responsibility for all major activities such as TLC, LOI, TEI, Entry, the exception being the launch phase. Training requirements are predicated on a lunar landing dress rehearsal mission (i.e. simulation of the lunar landing mission in lunar orbit), utilizing the Apollo Saturn 505 Launch Vehicle, Command Service Module 106 and Lunar Module 4. Author

N70-34369# Human Engineering Labs., Aberdeen Proving Ground, Md.
FP-50 FLIGHT DISPLAY EFFECTS ON VISION Technical Note, Feb. 1970
Harry R. Stowell, David J. Florip, and Robert W. Bauer Mar. 1970 29 p refs
(AD-705595; HEL-TN-2-70) Avail: CFSTI CSCL 5/5

The FP-50 flight display unit is designed to provide a visual display of aircraft attitude and certain tactical information to the pilot. A cathode ray tube (CRT) is used to display the information. It was anticipated the FP-50 display lighting in the cockpit would affect the pilots outside visual performance during night flight. The report summarizes both photometric measures and human factors experiments on the FP-50 with pilot subjects. Results indicated that the white light of the display had negligible effects on dark adaptation and visual acuity when operated at suitable low-level brightness for night flight. It was discovered, however, filters enhanced contrast of the display by three or four times at these low luminances. Author (TAB)

N70-34391# Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.
PARAMETERS OF HUMAN PATTERN PERCEPTION Semiannual Progress Report, 18 Sep. 1969 - 18 Mar. 1970
Selby H. Evans 18 Apr. 1970 24 p refs
(Contract DAAD05-68-C-0176; Proj. Themis)
(AD-705466; SAPR-5) Avail: CFSTI CSCL 5/10

The report is the fifth semi-annual progress report on a research program titled Parameters of Human Pattern Perception. Empirical development during this period has included: (1) Exploration of feature selection processes through sequential presentation paradigms and specification of statistical principles influencing these processes. (2) Elaboration of the schema plus correction hypothesis, along with a general methodology for studying visual pattern storage. (3) Investigation of the effects of extra-stimulus information (context) on pattern recognition performance. Progress on theoretical development has included elaboration of a general pattern recognition model, specification of a feature selection mechanism, and exploration of the utility of multivariate models. Author (TAB)

N70-34398*# General Electric Co., Philadelphia. Re-entry and Environmental Systems Div.
IDENTIFICATION OF A RECURRING BACTERIAL CONTAMINANT IN A SPACECRAFT WATERING SYSTEM
Armond J. Bryce 11 Aug. 1970 6 p Presented at 9th Ann. Tech. Meeting of the Am. Assoc. for Contamination Control, Anaheim, Calif., Apr. 1970
(Contract NAS2-1900)
(NASA-CR-73431) Avail: CFSTI CSCL 06M

The recurring bacterial contaminant found in the biosatellite water system was identified as Ps. boreopolis. The nature of the organism precluded its control without the employment of strict sterile procedures or chemical agents throughout the spacecraft manufacture and test cycle. Additional treatment of the water system by halogenation or other means would be required to control the contaminating organism. Author

N70-34441*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TWO-GAS ENVIRONMENTAL CONTROL FOR THE APOLLO COMMAND MODULE
W. E. Ellis 12 Jul. 1967 129 p refs Program Apollo Working Paper No. 1321
(NASA-TM-X-64337) Avail: CFSTI CSCL 06K

A two-gas atmospheric control system applicable to the Apollo Applications Program was designed and developed. The hardware is configured to integrate into the Apollo Command Module but is not flight qualified. The system selection, design, hardware status, and test results are described. Author

N70-34616*# National Aeronautics and Space Administration, Washington, D.C.
AIR ACCIDENTS OVER THE SEA AND SURVIVAL AT SEA [FLUGUNFAELLE UEBER SEE UND UEBERLEBEN AUF SEE]
A. Wentrup et al Aug. 1970 12 p Transl. into ENGLISH from Wehrdienst und Gesundheit (West Germany), v. 16, 1968 p 33-40
(NASA-TT-F-13182) Avail: CFSTI CSCL 06G

The possibilities of survival at sea following an air accident, based primarily on medical and technical consideration are discussed. A survey of existing rescue devices, particularly life-jackets, is presented. The principal dangers resulting from air accidents over sea, including death of drowning, supercooling, thirst, hunger, and physical exhaustion, are discussed in detail and appropriate measures for their prevention are suggested. Author

N70-34647# National Air Pollution Control Administration, Washington, D.C.
CONTROL TECHNIQUES FOR PARTICULATE AIR POLLUTANTS
Jan. 1969 241 p refs
(PB-190253; AP-51) Avail: SOD $1.75; CFSTI CSCL 13B

Particulate material found in ambient air originates from both stationary and mobile sources. Of the 11.5 million tons of particulate pollution produced by industrial, commercial, and domestic sources in 1966, 6 million tons were emitted from industrial sources, including industrial fuel burning; 5 million tons from power generation, incineration, and space heating; and 0.5 million tons from mobile sources. The following techniques are in use for controlling the source or reducing the effects of particulate pollution: Gas cleaning; Source relocation; Fuel substitution; Process changes; Good operating practice; Source shutdown; Dispersion.

USGRDR

N70-34670# National Air Pollution Control Administration, Washington, D.C.
CONTROL TECHNIQUES FOR SULFUR OXIDE AIR POLLUTANTS
Jan. 1969 144 p refs
(PB-190254; AP-52) Avail: SOD $1.25; CFSTI CSCL 13B

The document reports the major sources of sulfur oxide air pollution, and discusses the control techniques for fuel combustion processes, industrial processes, and dispersion from stacks as found in many industries. USGRDR

N70-34725*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MANUALLY ACTUATED HEAT PUMP Patent Application
William D. Hutchinson, inventor (to NASA) Filed 22 Oct. 1969 18 p
(Contract NAS7-100)
(NASA-Case-NPO-10677; US-Patent-Appl-SN-868530) Avail: CFSTI CSCL 13A

The heat pump utilizes the reversible process of the so-called Joule effect in rubber for generating heat energy in selectively heating and cooling a given atmospheric medium. The heat pump includes a pair of substantially disc-shaped webs, independently mounted in parallel planes for rotation in an abaxial relationship. By employing the novel concept of manually elongating and contracting elastomeric materials in a given ambient atmosphere, a highly efficient, economical and readily available heat pump is provided for use in selectively heating or cooling environmental atmospheres. NASA

N70-34754# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE ANNUAL CONFERENCE ON ATMOSPHERIC CONTAMINATION IN CONFINED SPACES (4th)
Dec. 1968 411 p refs
(AD-855001; AMRL-TR-68-175) Avail: CFSTI CSCL 6/11

This report is a compilation of the papers presented and the Proceedings of the 4th Conference on Atmospheric Contamination in Confined Spaces, sponsored by the Aerospace Medical Research Laboratories and held in Dayton, Ohio on 10, 11, and 12 September 1968. Major technical areas discussed included toxicological evaluation of atmospheres and contaminants, histopathological evidences of toxicity, evaluation of cabin materials, instruments and detection, and life support systems. Author (TAB)

N70-34761*# Scientific Translation Service, Santa Barbara, Calif.
ON THE PREVENTIVE MEASURES AGAINST FIRE AND BLAST HAZARDS IN THE ENVIRONMENT OF HIGH CONCENTRATION OF OXYGEN. ACCIDENTS IN THE PURE OXYGEN LOW-PRESSURE CHAMBER AT SAM AND LATER COUNTERMEASURES
H. Ikegami Washington NASA Aug. 1970 7 p refs Transl. into ENGLISH from Rept. of the Japan Air Self-Defense Force, Aeromed. Lab. (Japan), v. 10, Jun. 1969 p 48-50
(Contract NASw-2035)
(NASA-TT-F-13165) Avail: CFSTI CSCL 13L

A description is given of measures taken against the occurrence of fire and blast accidents in the chamber of high oxygen concentration at the School of Aerospace Medicine at Brooks Air Force Base, Texas. The measures adopted were aimed at the removal of ignitability, the elimination of combustibles, and the installation of ignition, smoke and overheating detectors, as well as fire extinguishers. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-33406# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Chemistry and Materials Div.
CHEMISTRY AND MATERIALS DIVISION Progress Report, 1 Jan.-31 Mar. 1970
31 Mar. 1970 104 p refs
(AECL-3556; PR-CMa-12) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $2.00

Research progress is reported on ion penetration, electron microscopy, radiation damage and deformation, nuclear methods of analysis, nuclear chemistry, analytical chemistry, fuel analysis, radioactivity measurements, heavy water analysis, electrochemistry, spark source mass spectrometry, radiation chemistry, isotope chemistry, surface chemistry, ceramic studies, metal physics, ternary fission studies, and X-ray diffraction analysis of oxide films. R.B.

N70-33430# Indiana Univ., Bloomington. Dept. of Chemistry.
AN ASSIGNMENT OF THE PROTON MAGNETIC RESONANCE SPECTRUM OF B10H14 AT 220 MHz
Lee J. Todd, George M. Bodner and Larry G. Sneddon May 1970 13 p refs Submitted for publication
(Contract N00014-67-A-0289-0003)
(AD-706049; TR-2) Avail: CFSTI CSCL 7/4

The 220 MHz proton nmr spectra of B10H14 and labeled derivatives have allowed the assignment of the major resonances to specific hydrogen atoms in the decaborane structure. The nmr measurements are solvent dependent with the largest shifts observed in the bridge hydrogen and B(2 and 4) hydrogen resonances. Author (TAB)

N70-33449# Tokyo Univ. (Japan). Inst. for Solid State Physics.
EXCITATION-INDUCED INFRARED OPTICAL ABSORPTION IN SILVER AND ALKALI HALIDES
Hiroshi Kanzaki, Takeshi Hattori and Shiro Sakuragi Sep. 1969 26 p refs Submitted for publication
(ISSP-A-382) Avail: AEC Depository Libraries

Excitation-induced absorption spectra in silver and alkali halides are obtained as excitation-spectra of ir-enhanced fluorescence measured by illuminating with monochromatic ir light simultaneously with steady uv or X-ray irradiation. The unusually slow decay of the induced absorption can be correlated with the slow decay component of fluorescence in silver halides. Long-lived triplet states of bound excitons are proposed for the origin of the induced absorption. Author (NSA)

N70-33500# Illinois Univ., Urbana. Dept. of Physics.
RAMAN SCATTERING FROM THE HYDROXYL ION IN ALKALI HALIDES
Wayne Robert Fenner (Ph.D. Thesis) Jul. 1969 78 p refs
(Contract ARPA-SD-131; Grant NSF GP-6581)
(AD-705535) Avail: CFSTI CSCL 20/12

Raman scattering has been observed from the hydroxyl ion in NaCl, KcI, and KBr crystals. The measurements were made using an argon ion laser as a light source and a tandem double monochromator with photoelectric detection. A Raman emission attributed to the stretching motion of the OH9(-) ion was seen in all samples. The stretching bands in KBr:OH(-) and KCl:OH(-) showed no resolvable structure. However, at 15 K, the stretching band in NaCl:OH(-) appeared to be composed of two lines separated by about 2.8/cm. RRaman scattering from the stretching level of OD(-) doped NaCl was observed whereas no corresponding infrared absorption has been seen. Author (TAB)

N70-33524# Stanford Univ., Calif. Dept. of Operations Research.
CHEMISTRY, KINETICS AND THERMODYNAMICS
James H. Bigelow Mar. 1970 73 p refs
(Contracts N00014-67-A-0112-0011; AT(04-3)-326; DAHC04-67-0028; Grants NSF GP-9329; NIH GM-14789-02)
(AD-706018; SU-TR-70-2) Avail: CFSTI CSCL 7/4

In the paper the equivalence of three ways of viewing

the classical chemical equilibrium problem is discussed. From the point of view of classical chemistry, this problem can be stated as follows: Given the set of reactions that may occur among all the species of a chemical system, their equilibrium constants, and the initial composition of the system (i.e. the amounts of each species present in the system initially), find the equilibrium composition of the system. From the point of view of kinetics, the problem is to determine the evolution of the various parameters describing the system from their initial values. When the parameters cease to change, the system must be in equilibrium. Given the same system, thermodynamics seeks that composition at which the usable (or free) energy remaining in the system is at a minimum. It can be shown that the system will then be at equilibrium. Much of the materiel contained herein is old. It is presented here in a consistent notation, and in a way intended to emphasize the common aspects of the three points of view. Author (TAB)

N70-33582# United Kingdom Atomic Energy Authority, Wantage (England). Nuclear Physics Div.

A METHOD OF OVERCOMING MATRIX EFFECTS IN THE ANALYSIS OF COPPER ORES BY RADIOISOTOPE X-RAY FLUORESCENCE USING THE RATIO OF CHARACTERISTIC TO SCATTERED RADIATION

S. Dziunikowski and C. G. Clayton Dec. 1969 19 p refs
(AERE-R-5914) Avail: AEC Depository Libraries: HMSO 3s 6d; BIS $0.70

A method is described for overcoming matrix effects due to variations in the concentration of iron and in general lithology on the measurement of the copper concentration of copper ores when no other major interfering elements are present. It is based on compensating for the effects of variations in mean atomic number of the base matrix on the measurement of Cu K and Fe K X-ray intensities, using differential filter techniques, thereby reducing the problem to one of single element interference, capable of being resolved by means of a nomogram. Author (NSA)

N70-33598# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.

INFRARED AND RAMAN SPECTROSCOPIC STUDIES ON COMPLEX COMPOUNDS OF TITANIUM (III) [INFRAROT-UND RAMAN-SPECTROSKOPISCHE UNTERSUCHUNGEN AN TITAN (III)KOMALEXVERBINDUNGEN]

Gunter Stefaniak (Ph.D. Thesis) Feb. 1970 82 p refs
Avail: CFSTI

Studied were crystal structure and symmetries of a number of titanium (3) complex compounds of the type (TiL sub 6) + or - 3. Infrared and Raman spectra of deformed crystal symmetries in the T sub 2g ground level of the octahedron were normalized by He/Ne laser through tetragonal (→ D sub 4h) as well as trigonal distortion of the symmetry (→ D sub 3d, D sub 3). Analyses of halogeno and aqueous complex titanium compounds proved that the force constants of the metal-halogen bond are larger in water containing complexes than in corresponding pure halogen compounds. An especially large valency force constant was found for the H2O trans-coordinated chlorine in M2[TiCl5(H2O)]. Transl. by G.G.

N70-33630# Institute of Nuclear Research, Warsaw (Poland).

INFLUENCE OF TEMPERATURE AND RESIN CROSS-LINKING ON ION EXCHANGE REACTIONS AND CHROMATOGRAPHIC SEPARATIONS [WPLYW TEMPERATURY I USIECIOWANIA JONITU NA REAKCJE WYMIANY JONOWEJ I PRZEBIEG ROZDZIELAN CHROMATOGRAFICZNYCH]

Raimund Dybczynski 1969 184 p refs In POLISH; ENGLISH summary
(INR-1115; Rept-1115/VIII/C) Avail: AEC Depository Libraries

Examination of equilibria and the thermodynamics of cation exchange of alkali metals on sulfonic and phenolsulfonic cation exchange resins, and anion exchange of the rare earth complexes with EDTA and DCTA on strongly basic anion exchange resins supplied enough data for the general characterization of the influence of temperature and resin crosslinking on ion exchange equilibria. It is shown that the theories being currently in use in ion exchange chromatography in some cases fail to give an exact description of the elution process. It is also shown that the commonly used empirical rules predicting the effect of temperature and resin cross linking on ion exchange separation do not have a universal meaning. The possibility of reasoning about the nature of bond between counter ion and resin functional group, as well as about the structure of complex ions in solution from the analysis of respective thermodynamic functions was pointed out. Author (NSA)

N70-33639# United Kingdom Atomic Energy Authority, Harwell (England). The Research Group.

RATE CONSTANTS FOR THE REACTIONS OF CERTAIN DYES WITH HO2 RADICALS AND HYDRATED ELECTRONS FORMED BY THE CO 60 gamma-RADIOLYSIS OF AQUEOUS SOLUTIONS

N. T. Rakintzis Sep. 1968 6 p refs Transl. into ENGLISH from Z. Physik. Chem. (Frankfurt), v. 57, 1968 p 99-102
(TIL/OT/9119) Avail: CFSTI

The radiolysis of water by the action of high energy radiation proceeds according to the general scheme H2O yields OH,H, e sub aq(-), H sub aq(+), H2, H2O2. The rate constants for reactions of certain dyes with HO2 radicals were determined in the presence of .005 M 2,5-dichlorohydroquinone, in which the dye concentration was varied for each experiment. R.B.

N70-33642# Engelhard Industries, Inc., East Newark, N.J. Instruments and Systems Dept.

MODIFICATION OF A HYDROGEN GENERATOR ML-539/TM TO PRODUCE PURE HYDROGEN Final Report, 4 Dec. 1967 - 14 Dec. 1969

James R. Ryan and Martin F. Collins 6 Mar. 1970 145 p refs
(Contract F19628-68-C-0172)
(AD-705573; AFCRL-70-0151) Avail: CFSTI CSCL 7/1

A hydrogen generator ML-539/TM (serial no. 13) which was originally designed to produce 400 scfh of dissociated ammonia (75% hydrogen and 25% nitrogen), was modified to produce 400 to 450 scfh of pure (99%) hydrogen. The major changes in the generator were the adding of two palladium alloy diffusion chambers for purification of the dissociated ammonia, installing a flame safety device in order to monitor the firing of the oil burner into the combustion chamber and reworking the dissociator retort for operation at higher pressure. A rugged, electrically heated, ammonia cylinder box was designed and built to replace the previously used electric heating blanket. It successfully passed a low temperature test. Shock, vibration, and low temperature tests were successfully conducted on the modified generator. In addition to the above tests, the flame safety device successfully passed fungus, and high temperature tests. Author (TAB)

N70-33868# Research Triangle Inst., Durham, N.C. Camille Dreyfus Lab.

TIME EFFECTS IN VISCOSITY OF POLYMER SOLUTIONS Final Report, 1 Mar. 1967 - 28 Feb. 1970

A. Peterlin, U. Bianchi, P. Munk, H. Olf, and D. T. Turner 28 Apr. 1970 25 p refs
(Contract DAHC04-67-C-0038)
(AD-705385; AROD-6995-6-C) Avail: CFSTI CSCL 7/4

The time dependence of rheological and rheooptical properties of dilute polymer solutions was studied on solutions of high molecular weight polymers in extremely viscous solvents as chlorinated diphenyl and oligobutenes. The choice of solvent and solute was based on the model of aggregate formation in laminar

flow which predicts the dimer formation by two solute molecule collision as the first step in aggregation which shows up in the time dependence of viscosity. As a by-product of this investigation one could obtain valuable data on streaming birefringence of polymer solutions at extremely high values of the dimensionless gradient parameter where, according to the theory, the first indications of saturation are expected to be caused by finite macromolecule length. Beyond that the study of the expansion of macromolecules in laminar flow with transverse and longitudinal gradient lead to a simple molecular model of drag reduction by high polymer additives of high molecular weight. Author (TAB)

N70-33768# Environmental Science Services Administration, Boulder, Colo. Research Labs.
COMPILATION OF REACTION RATE CONSTANTS MEASURED IN THE ESSA FLOWING AFTERGLOW SYSTEM TO AUGUST, 1969
F. C. Fehsenfeld, A. L. Schmeltekopk, D. B. Dunkin, and E. E. Ferguson Sep. 1969 27 p refs
(ESSA-TR-ERL-135-AL-3) Avail: SOD $0.35

The reaction rate constants measured to August, 1969 in the ESSA flowing afterglow system were compiled and tabulated in this report. The references to original publications are included along with references to several published reviews on specialized aspects of ion-molecule reactions. Because of the large number of measured rate constants (several hundred) this report should be useful as a reference source and finding list. Author

N70-33775# Arizona Univ., Tuscon. Dept. of Chemistry.
[CHLOROPHYLL PHOTOCHEMISTRY, FLAVIN REDOX CHEMISTRY, AND PHOTOTAXIS IN EUGLENA] Technical Progress Report, 1 Jun. 1969 – 31 May 1970
Gordon Tollin 31 May 1970 13 p
(Contract AT(11-1)908)
(COO-908-29) Avail: CFSTI

Data on chlorophyll-quinone photoreactions in alcohol solvents were obtained using flash photolysis, steady state absorbance changes, and ESR, and a summary of conclusions concerning reaction mechanisms is given. Investigations of the redox properties of the flavin free radical, the reactions of flavin radicals with oxygen and ferricyanide, and the use of fluorescence as a probe of flavin environment in Shethna flavoprotein are briefly described. Efforts in Euglena phototaxis research to separate the photoreceptor pigment-containing structure from the remainder of the cell are mentioned. N.E.N.

N70-33815# Boeing Scientific Research Labs., Seattle, Wash.
HYDROXYLATION OF POLYMETHYLSILOXANE SURFACES BY OXIDIZING PLASMAS
John R. Hollahan and George L. Carlson Apr. 1970 19 p refs
(AD-705205; D1-82-0966) Avail: CFSTI CSCL 7/3

The reaction of a radiofrequency oxygen plasma with the surfaces of cured and uncured polymethylsiloxane produces intense hydroxylation of the surface region as followed by FMIR spectroscopy. Characteristic infrared features indicative of intra- or intermolecular hydrogen bonding are evident. Plasma oxidation differs markedly from thermal oxidation processes. Reactions of polymethylsiloxane with nitrogen and air plasmas were also investigated and compared to corona reactions of oxygen, nitrogen, and air. In air corona, nitrogen moieties appear to be introduced. The behavior of polymethylsiloxane surfaces in oxidizing acids is also described. Author (TAB)

N70-33825 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
REPORT OF THE NUCLEAR CHEMISTRY SECTION [BERICHT DES SEKTOR KERNCHEMIE]
In its Ann. Rept. 1969 May 1970 35 p refs In GERMAN
(See N70-33824 18-24)
(BC-49) Copyright. Avail: Issuing Activity

The following studies were performed during 1969 in the nuclear chemistry department of the institute: (1) ion mass range and nuclear knockout effects in irradiated solids; (2) mobility of gas bubbles and gaseous diffusion in solids; (3) exchange diffusion in silicate ion exchangers and ion crystals; (4) fixation of radionuclides in glasses and solids; (5) separation and preparation methods for nuclear chemistry; and (6) activation analysis, mass spectrometric trace element determination, and radioactive tracing methods. Transl. by G.G.

N70-33829 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
REPORT OF THE RADIOCHEMISTRY SECTION [BERICHT DES SEKTORS STRAHLENCHEMIE]
In its Ann. Rept. 1969 May 1970 18 p refs In GERMAN
(See N70-33824 18-24)
(BS-7) Copyright. Avail: Issuing Activity

Briefly reviewed are radiological studies performed at the institute during the last 10 years. Current research activities centered on pulse radiolytic determination of absorption spectra and dissociation constants of organic compounds in aqueous solutions, reaction kinematics and mass spectra of ion-transfer reactions, and the effects of gamma radiolysis on molecular structures of solids and organic solutions. Transl. by G.G.

N70-33833# Chicago Univ., Ill. Dept. of Chemistry.
ELECTRONIC PROPERTIES OF MOLECULAR SOLIDS Final Report
Norman H. Nachtrieb 16 Mar. 1970 16 p
(Grant AF-AFOSR-1087-66)
(AD-705661; AFOSR-70-1154TR) Avail: CFSTI CSCL 7/3

The effects of hydrostatic gas pressure on the electrical conductance of crystalline charge transfer comlexes of the quinhydrone type were investigated. Procedures for the synthesis purification, and growth of single crystals of a variety of complexes from solution were developed. Time-dependent, transient currents are observed in high resistance complexes, attributable to the flow of charges to local traps. Large transient increases in conductance with pressure are observed. Reversible increases in conductance with pressure are small but reproducible. Author (TAB)

N70-33898# Stanford Univ., Calif. Operations Research House.
COMPUTING EQUILIBRIUM COMPOSITIONS OF IDEAL CHEMICAL SYSTEMS
James H. Bigelow Mar. 1970 76 p refs
(Contracts N00014-67-A-0112-0011; DAHC04-67-C-0028; AT(04-3)-326; Grants NSF GP-9329; PHS GM-14789-02)
(AD-706020; SU-TR-70-4) Avail: CFSTI CSCL 7/4

Six iterative methods are given for solving the chemical equilibrium problem, four primal and two dual. In chemical terms, each composition produced by a primal method satisfies the mass-balance laws while successive iterates more nearly satisfy the mass-action laws. Dual methods do the reverse. Also presented are two formulations of the chemical equilibrium problem as a more general linear-logarithmic problem, and two methods for solving the general problem. Of the four resulting primal methods, two (the Linear methods) need not converge to an optimal solution. The other two (the Quadratic methods) if applied to an appropriately modified chemical equilibrium problem, will certainly converge. Author (TAB)

N70-33911# Stanford Univ., Calif. Operations Research House.
DEGENERACY IN IDEAL CHEMICAL EQUILIBRIUM PROBLEMS
James H. Bigelow Mar. 1970 53 p refs
(Contracts N00014-67-A-0112-0011; DAHC04-67-C-0028; AT(04-3)-326; Grants NSF GP-9329; PHS GM-14789-02)
(AD-706019; SU-TR-70-3) Avail: CFSTI CSCL 7/4

A single- or multi-phase chemical equilibrium problem may be though of as the problem of minimizing a particular nonlinear function (the free energy) of composition subject to the conditions that the composition vector be nonnegative and satisfy a system of linear equations (the mass-balance laws). It was pointed out in a previous paper (AD-706 018) that the free energy is convex and homogeneous of degree one, but that as a variable approaches zero, the free energy may behave badly. In this paper, the phase chemical equilibrium problem refers only to a problem with a particular mathematical form. Problems of this form arise in many situations that are not classically denoted chemical equilibrium problems. Author (TAB)

N70-33939*# Tennessee Univ., Knoxville. Dept. of Physics and Astronomy.

A STUDY OF THE INTENSITY OF THE SELF-BROADENED FUNDAMENTAL BAND OF HYDROGEN CHLORIDE

S. C. Burnett and R. J. Lovell [1970] 10 p refs

(Grant NGL-43-001-006; Contract AF 19(604)-7981)

(NASA-CR-109867) Avail: CFSTI CSCL 07D

The variation with pressure of the contour of the fundamental vibration-rotation band of hydrogen chloride was examined spectroscopically. A very short path length absorption cell was designed and built to facilitate this investigation. The intensity of this band was calculated for pressures of the absorbing gas from 20 to 50 atm. The work indicated that the band intensity for polar molecules was definitely an increasing function of pressure. The band intensity was expressed as a function of density and was found to be inversely proportional to the gas density. Evidently, a failure of Beer's law was occurring at the large densities of gas used. Author

N70-33992*# Brigham Young Univ., Provo, Utah.

STUDIES OF REACTION GEOMETRY IN OXIDATION AND REDUCTION OF THE ALKALINE SILVER ELECTRODE Quarterly Report

Eliot A. Butler and Angus U. Blackham 15 Aug. 1969 34 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952268)

(NASA-CR-109857; QR-5) Avail: CFSTI CSCL 07D

The charge acceptance by silver foil electrodes under potentiostatic conditions in alkaline solution has been measured by current-time integral, constant current reduction, and atomic absorption techniques. All measurements show the same charge acceptance versus potential relationship, thus indicating that the large maxima and minima in the charge acceptance are real. Results from potential sweep oxidations suggest the formation of two types of silver (I) oxide. This fits in with the proposal that the initial silver(I) oxide is a thin layer of randomly oriented crystallites. Model pore electrodes of several pore sizes were constructed and have demonstrated that a decrease in pore size is accompanied by a shorter penetration of oxide into the pore. Penetration is also shortened by increased velocity of electrolyte flow. The reaction current density was approximately the same for oxidations of equal plateau length, regardless of pore size. The design of the model pore electrode shows considerable promise in the investigation of reactions in the confines of a pore. Author

N70-34010*# Stanford Univ., Calif.

[PHOTOEMISSION FROM ALKALI AND SILVER HALIDES] Quarterly Status Report, Period Ending 30 Apr. 1970

W. E. Spicer 30 Apr. 1970 16 p refs

(Grant NGR-05-020-066)

(NASA-CR-109881; SU-QSR-8) Avail: CFSTI CSCL 07D

This quarter saw the conclusion of the alkali halide work and an abstract of this thesis is included in this report. Completed photoemission measurements on the silver halides gave new experimental data; a theoretical investigation of the very large temperature effects found in the silver halides was performed. Experimental methods were devised so that temperature could be varied continuously between room and liquid nitrogen temperatures. As a result, more detailed information on the temperature dependence has been obtained. This detailed information is found to be in agreement with the theoretical models. In addition to the work reported, preliminary work has been done in two new areas: (1) estimates of photoemission from the surface of the moon; and (2) development of photoemission to serve as standard absolute detectors in the ultraviolet. Author

N70-34023# Aerochem Research Labs., Inc., Princeton, N.J.

CHEMILUMINESCENT EMISSION OF CO FOURTH POSITIVE BANDS IN NITROGEN ATOM/OXYGEN ATOM/REACTIVE CARBON COMPOUND SYSTEMS

William H. Smith (Princeton Univ.), James E. Hesser (Princeton Univ.), Arthur Fontijn, and Roy Ellison Apr. 1970 37 p refs

(Contract N00014-67-A-0226-0005; Proj. Squid)

(AD-706070; TP-238; AC-10-PU) Avail: CFSTI CSCL 7/4

Emission of the CO Fourth Positive Bands (A singlet Pi - X singlet Sigma(+)) is observed in the reactions of atomic N/O mixtures with C2F4, C2H4, C2H2, and C2N2 at about 300 K and pressures of 1-4 Torr. The N/O/C2F4 system, which has been investigated most extensively, produces CO (A singlet Pi - X singlet Sigma(+)) emission. It is shown that the formation of CO(A singlet Pi) can be attributed to enhanced formation of excited N2 and NO molecules in atom recombination reactions induced by a reaction intermediate (probably CN), followed by pooling of the energy of an N2* and an NO* molecule and energy transfer to the reaction product CO(X singlet Sigma(+)). The transfer reaction can take place before or after the pooling reaction. TAB

N70-34031# Ohio Univ., Athens. Dept. of Chemistry.

THE THERMODYNAMICS OF DISSOCIATION OF TRIOXOBROMOCHROMATE (VI) AND THE FORMATION OF TRIBROMIDE IONS AND THE KINETICS OF OXIDATION OF BROMIDE IONS BY CHROMIUM (VI)

James Y. Tong and A. R. Zembrodt 1969 154 p refs

(Contract AT(11-1)-687)

(COO-687-23) Avail: CFSTI

The investigation was conducted to determine the dissociation constant of the trioxobromochromate(VI) ion in aqueous acidic solutions and the enthalpy and entropy changes associated with the reaction, to determine the rate equation for the reduction of chromium(VI) in aqueous acidic solutions of bromide ion and to obtain the enthalpy and entropy of activation, and to obtain a formation constant for the tribromide ion in aqueous acidic solutions of bromine and bromide ion and the changes in entropy and enthalpy of the formation reaction. Detailed derivations using Beer's law and thermodynamic concepts of the equilibrium constant for the analysis of the spectrophotometric data are given. All the studies were carried out at unit ionic strength except for the kinetic study, and all concentrations were based on the molarity scale. NSA

N70-34054# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

SPECIE CONCENTRATIONS MEASUREMENTS UTILIZING RAMAN SCATTERING OF A LASER BEAM

George F. Widhopf and Samuel Lederman Nov. 1969 108 p refs

(Contracts DAHC04-69-C-0077; Nonr-839(38); ARPA Order 1442; ARPA Order 529)

(AD-701343; PIBAL-69-46) Avail: CFSTI CSCL 7/4

The feasibility of utilizing Raman scattering as a diagnostic technique to measure individual specie concentrations in typical gas mixtures found in gas dynamic applications has been investigated and demonstrated. Utilizing this technique, either the local density of a pure gas or the concentration of individual diatomic (or polyatomic) species in a gas mixture can be uniquely determined.

The range and limitations of this technique were investigated and evaluated under controlled static conditions. A Q-switched ruby laser, which has a pulse duration of approximately 10 nanoseconds, was used as a radiation source. The scattered radiation was monitored utilizing a high gain, wide spectral range photomultiplier tube in conjunction with a spectrograph. Measurements were also made utilizing narrow bandpass filters in place of the spectrograph. The species which were investigated include O2, N2, CO2, and CH4. Quantitative results are given for these gases in their pure state as well as in various mixture proportions. The relative and absolute intensity of the scattered radiation from the species investigated were compared with that predicted by theory. Measurements were also made of the vibrational temperature of O2. A description of the pertinent theory and concepts of Raman scattering is also included as well as a discussion of the limitations of the technique. Author (TAB)

N70-34148# Hebrew Univ., Jerusalem (Israel). Dept. of Physics.
SPECTROSCOPY IN THE VACUUM ULTRAVIOLET RANGING FROM 40 TO 500 ANGSTROM Final Scientific Report, 1 Jun. 1967 – 30 Sep. 1969
E. Alexander, B. Fraenkel, and S. Goldsmith Feb. 1970 30 p
(Contract F61052-67-C-0101)
(AD-705152) Avail: CFSTI CSCL 7/4

The spectra of Be(III), Be(IV), Fe(VII) to Fe(XI), Co(IX), to Co(XI), Ni(X), to Ni(XI), Cu(X), to Cu(XIII), Zn(XI) to Zn(XIII), Ga(XII), Ge(XIII), Y(IX) to Y(XIII), Zr(X) to Zr(XIV), Nb(XI) to Nb(XV), and Mo(XII) to Mo(XVI) were studied. These spectra were produced by an intense vacuum spark, operated in a triggered mode. Radiative transitions from autoionizing levels of Be III were observed close to the Lyman alpha line of Be IV. These transitions were classified and the dependence of their intensities on the discharge parameters was determined. A new method for estimating electron temperature was suggested. A new phenomenon of line splitting in extremely dense plasma was observed. The study of the fifth row elements is difficult due to the lack of previous investigation. Here some pioneer work was done. More than 200 new lines of Y, Nb, Zr, and Mo were identified, and a great part of them classified. A new X-ray spectrometer was invented and built to facilitate the study of X-ray spectra emitted from the spark. Author (TAB)

N70-34155# Picatinny Arsenal, Dover, N.J.
THE EFFECTS OF REACTOR IRRADIATION ON THE CHEMICAL CHARACTERISTICS OF SOLID EXPLOSIVES
Charles Ribaudo, James Mallay, and Harold J. Matsuguma Jan. 1970 75 p refs
(AD-701876; PA-TR-3893) Avail: CFSTI CSCL 19/1

A study was made of TNT, HMX/EXON (9505), DATB, and PETN which had been irradiated in a nuclear reactor to determine chemical changes induced by the irradiation. Chemical changes (stability) were determined by infrared spectrophotometric, x-ray diffraction, and differential thermal analysis of the post-irradiated explosives. In addition, a similar study of nitrocellulose-base propellants was carried out. From the data obtained, the order of decreasing chemical stability under irradiation was DATB, HNX/EXON, TNT, PETN, and the nitrocellulose-base propellants; DATB was found to be the most stable. Author (TAB)

N70-34206# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
TRANSFER OF EXCITATION IN SOLUTION Final Technical Report, 1 Nov. 1964 – 31 Oct. 1969
George S. Hammond 1 Apr. 1970 30 p refs
(Contract AF 49(638)-1479)
(AD-705249; AFOSR-70-1112TR) Avail: CFSTI CSCL 7/5

During the report period new mechanisms for energy transfer have been uncovered and partially elucidated. The understanding of structure-reactivity relationships in both classical and nonclassical transfer processes has been estended. A useful program in study of complex excited states in bichromophoric molecules has developed well. Author (TAB)

N70-34228# California State Coll., Los Angeles. Dept. of Chemistry.
THE CHLORINATION OF C2B5H7
Richard Warren, Don Paquin, Thomas Onak, Gary Dunks, and John R. Spielman Apr. 1970 18 p refs
(Contract Nonr-3364(00))
(AD-705613; TR-26) Avail: CFSTI CSCL 7/2

The closo-carborane, C2B5H7, reacts rapidly with Cl2 in the presence of AlCl3 to form HCl and 4-ClC2B5H6. The reaction without AlCl3 is accelerated by light forming, in addition to the 4-isomer, 1-ClC2B5H6 and 2-ClC2B5H6. The identity and structure of the new compounds are indicated by their mass spectra and 11B nmr spectra. A trans effect is observed in the 11B nmr of the 1-chloro derivative and reciprocal effects are observed in all compounds. Author (TAB)

N70-34234# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL CONDUCTIVITY OF MOLTEN CHALCOGENIDES OF VARIOUS NONFERROUS METALS
A. S. Okhotin et al 26 Mar. 1970 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Tsvetn. Met. (Dzaudzhikau), no. 2, 1969 p 30 – 34
(AD-705243; FTD-HT-23-172-70) Avail: CFSTI CSCL 7/4

The thermal conductivities of molten SbTe3, Bi2Te3, and Bi2Se3 is estimated theoretically on the basis of existing data relating to the electrophysical properties of these compounds in the solid state, together with the theory of heat conduction in the corresponding solid materials. The results are compared with experimental values. Agreement is in general reasonable, e.g., according to theory, Bi2Te3 has a thermal conductivity of 28 W/cm degrees centigrade at 1100 degrees centigrade, while according to direct experiment, the value is 25 W/cm degrees centigrade. Author (TAB)

N70-34328 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF A POLYFLUORO-ALKYL GROUP ON THE PROPERTIES OF POLYURETHANES [VLIYANIE POLIFTORALKOKSILNOI GRUPPY NA SVOISTVA POLIURETANOV]
B. F. Malichenko et al Apr. 1970 3 p Transl. into ENGLISH from Vysikomol. Soedin. Kratkie Soob. (USSR), v. 11B, no. 4, 1969 p 246
(NLL-RTS-5774) Avail: Natl. Lending Library, Boston Spa Engl. 5s or 1 NLL photocopy coupon

A new principle has been developed for synthesising a flexible polyurethane chain using new polyfluoro alkyl arylene diisocyanates. Films of these polyurethanes do not become brittle at -30 to -90 C, even after repeated deformation. The conversion of the polyurethanes into products can be carried out by any of the well known methods. Author

N70-34333*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
Mg(2+)-Fe(2+) ORDER-DISORDER IN ORTHOPYROXENE AND THE Mg(2+)-Fe(2+) DISTRIBUTION BETWEEN COEXISTING MINERALS
Surendra K. Saxena Jul. 1970 23 p refs Submitted for publication
(NASA-TM-X-63991; X-644-70-288) Avail: CFSTI CSCL 08D

An approximate temperature of crystallization of rocks and important information on the thermodynamic nature of a crystalline solution, coexisting with orthopyroxene, is obtained by using the

experimental Mg(2+)-Fe(2+) intracrystalline distribution data in orthopyroxenes at various temperatures and the Mg(2+)-Fe(2+) intercrystalline distribution data in natural assemblage. Ca-pyroxene Ca (Mg,Fe) Si2O6 with the M2 site nearly filled by Ca, is a 'simple mixture' of Mg(2+) and Fe(2+) components with an energy constant w approximately 1100 cal/mole at 600 C. The estimated temperature of ion-exchange equilibrium between coexisting cummingtonite and orthopyroxene in the Biwabik iron formation, Minnesota is 610 C. Cummingtonite also approximates to a 'simple mixture' with w as 700 cal/mole at 600 C. Author

N70-34345*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

Mg(2+)-Fe(2+) ORDER-DISORDER AND THE THERMODYNAMICS OF THE ORTHOPYROXENE (Mg, Fe) Si 03 CRYSTALLINE SOLUTION

Surendra K. Saxena and Subrata Ghose Jul. 1970 28 p refs Submitted for publication

(NASA-TM-X-63988; X-644-70-266) Avail: CFSTI CSCL 07D

Activity-composition relation obtained from the intra-crystalline Mg(2+)-Fe(2+) distribution data for orthopyroxene, (Mg,Fe)SiO3 at 500, 600, 700 and 800 C are presented. The activity coefficients are expressed as a polynomial in the mole fraction X sub Fe according to Redlich and Kister Equations. The excess free energy of mixing is similarly expressed using Guggenheim's Equation. The two constants A sub 1 and A sub 2 decrease systematically with increasing temperature. A sub 0 increases from 800 to 600 C but decreases again at 500 C. The orthopyroxene solution is asymmetric and the asymmetry increased with decreasing temperature. Theoretically orthopyroxene on the Fe-rich side would begin to unmix into two coexisting pyroxenes in the vicinity of 500 C. Author

N70-34358 National Lending Library for Science and Technology, Boston Spa (England).

CHEMISTRY: NOTES FROM MOSCOW, NO. 206

27 Feb. 1970 5 p Transl. into ENGLISH from Russian newspapers (NLL-Trans-206-(6167.650)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The production of neptunium and plutonium in the heptavalent state is discussed. The transition from the hexavalent to heptavalent state was predicted by Mendeleyev law and oxidation reduction using ozone yielded the desired sediment. It is proposed that the Mendeleyev law can be applied to other transuranium elements to determine their highest valence. R.B.

N70-34383# Naval Medical Research Inst., Bethesda, Md. Bio-Energetics Labs.

ULTRASENSITIVE REACTION CALORIMETRY Interim Research Report

Theodor H. Benzinger 1969 72 p refs Submitted for publication

(AD-705048; NAVMED-MR-005.01.01-0001B-11) Avail: CFSTI CSCL 6/1

Discussed is calorimetry which is applicable to proteins and to other macromolecular systems. The potential of ultrasensitive reaction-calorimetry in protein research must be derived from first principles. The liberation of heat as a non-specific, quantitative indicator of chemical change has no parallel in other phenomena that have been exploited for chemical analysis. Calorimetry has conceptually the potential of covering those areas for which no other analytical methods exist. While the non-specific nature of heat demands certain precautions, specificity can be provided by experimental design. Examples of such analytical application are reported. Also discussed is the application of ultrasensitive calorimetry to thermodynamic problems, directly to the heat of reaction as one of the two driving forces of chemical change in classical definition, and indirectly to the other driving force, entropy of reaction at finite temperature. Calorimetric determinations of chemical equilibrium make such an analysis possible. The principle of the method, its instrumentation and experimental procedures is described first, then its analytical as well as thermodynamic applications. Author (TAB)

N70-34398# Chicago Univ., Ill. Enrico Fermi Inst.

NUCLEAR CHEMISTRY RESEARCH Technical Progress Report, 15 Dec. 1968 - 15 Dec. 1969

Nathan Sugarman and Anthony Turkevich 15 Dec. 1969 15 p

(Contract AT(11-1)-1167)

(COO-1167-9) Avail: CFSTI

Progress in radiochemical research at the Enrico Fermi Institute of the University of Chicago during the period Dec. 15, 1968 to Dec. 15, 1969 is described. NSA

N70-34503# Union Carbide Corp., Oak Ridge, Tenn. Oak Ridge Gaseous Diffusion Plant.

ENGINEERING DEVELOPMENT OF AN ABSORPTION PROCESS FOR THE CONCENTRATION AND COLLECTION OF KRYPTON AND XENON Progress Report, Jul. - Dec. 1968

J. R. Merriman and J. H. Pashley 1 Apr. 1970 24 p refs

(Contract W-7405-eng-26)

(K-1786; PR-4) Avail: CFSTI

A continuous selective absorption process for the removal of krypton-85 and xenon-155 from contaminated gas streams by preferential dissolution in a fluorocarbon solvent is being developed. The most important part of the program is pilot plant testing, which is being conducted to determine feasibility and to define the main performance parameters in terms of the operating variables. The pilot plant work is supplemented by conceptual plant design work and by process optimization studies. Refrigerant-12 was used as a process solvent, pilot plant shakedown was completed, and the formal testing program was begun. The conceptual design work was limited to further investigation of solvent radiolytic decomposition in the absorption process. The optimization studies included analyses of three absorption plants designed to treat off-gases from fuel reprocessing systems. Author (NSA)

N70-34551# National Air Pollution Control Administration, Durham, N. C.

ATMOSPHERIC EMISSIONS FROM HYDROCHLORIC ACID MANUFACTURING PROCESSES

Samuel L. Bean (Allied Chemical Corp.) and Howard Wall, Jr. Sep. 1969 66 p refs

(PB-190256; AP-54) Avail: SOD $0.35; CFSTI CSCL 13B

The report is one of a series on atmospheric emissions from chemical manufacturing processes. It provides such information on the manufacture of hydrochloric acid. Basic characteristics of the industry, including growth rate, manufacturing processes, product uses, and the number of producing plants in the United States are discussed. Process descriptions are given for the chlorinated by-product process and the synthesis process, which employs the direct combustion of hydrogen in chlorine. Process information includes the range of emissions of hydrogen chloride from hydrochloric acid manufacturing plants and the methods of limiting or controlling these emissions to the atmosphere. Although other contaminants such as chlorine, chlorinated organics, and other hydrocarbons emitted to the atmosphere from these plants are mentioned and in some cases discussed, they are not the primary concern of this report. Detailed descriptions of the sampling and analytical methods used for measuring such emissions are also included. Author (USGRDR)

N70-34569# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

CHEMICAL EFFECTS IN MICROMOLAR NITRIC ACID FROM GAMMA RADIATION AND HEATED ALUMINUM. A LABORATORY STUDY WITH APPLICATION TO SRP REACTORS

Elizabeth W. Baumann Jan. 1970 21 p refs

(Contract AT(07-2)-1)

(DP-1208) Avail: CFSTI

The effects of gamma radiation and heated aluminum on 20 micromolar HNO3 were studied to determine the causes of occasional pD in stability in the D2O moderator of the Savannah River reactors. At doses of 5 million rad, 70% of the initial concentration of the nitric acid (helium-saturated) was maintained. When hydrogen or organic reducing agents were present, all the nitric acid was lost at doses below .2 million rad. Freshly cleaned aluminum at 100 C, contacted with stirred air-free solutions at 75 C, caused a loss of >80% of the H(+) and 50% of the NO3(−) in one hour. Treating the aluminum with lithium silicate solution reduced these acidity losses to 30%. Author

N70-34625*# Translation Consultants, Ltd., Arlington, Va.
INHIBITION OF THE CHEMISORPTION OF OXYGEN, HYDROGEN AND CHLORINE ON ATOMICALLY PURE GRAPHITE SURFACE BY THE SURFACE REACTION PRODUCTS [INGIBIRUYUSHCHEYE DEYSTVIYE PRODUCTOV POVERKHNOSTNOY REAKTSII NA KHEMOSORBSTIYU KISLORODA, VODORODA I KHLORA NA ATOMARNO-CHISTOY POVERKHNOSTI GRAFITA]
O. V. Nikitina et al. Washington NASA Aug. 1970 8 p refs Transl. into ENGLISH from Kinet. Katal. (USSR), v. 10, no. 6, 1969 p 1387–1389
(Contract NASw-2038)
(NASA-TT-F-13163) Avail: CFSTI CSCL 07D

An irreversible chemisorption of O2, H2 and Cl2 at 300 and 650 K was investigated on prismatic faces of atomically pure graphite surface obtained by crushing graphite crystals in ultrahigh vacuum at 300 K. It is shown that the products of the reaction of the investigated gas on the surface of carbon has an inhibiting effect on the chemisorption of this gas on the atomically pure surface of graphite. Author

N70-34650# National Air Pollution Control Administration, Raleigh, N.C.
AIR POLLUTION ASPECTS OF BRASS AND BRONZE SMELTING AND REFINING INDUSTRY
Stanley T. Cuffe and Earl S. Schwartz Nov. 1969 65 p refs
(PB-190259; AP-58) Avail: SOD $0.35; CFSTI CSCL 13B

The report covers: Manufacturing processes; Emissions from brass and bronze production; Control of emissions; Emission guidelines. USGRDR

N70-34653*# Battelle Memorial Inst., Columbus, Ohio.
METHOD FOR DETERMINING PRESENCE OF OH IN MgO Patent Application
Ellsworth R. Blosser, Robert B. Iden, and Elton H. Hall, inventors (to NASA) Filed 11 Aug. 1969 13 p Prepared for JPL
(Contract NAS7-100)
(NASA-Case-NPO-10774; US-Patent-Appl-SN-848805) Avail: CFSTI CSCL 07D

A method for determining the amount and type of OH present in MgO is described. The method consists of heating MgO in a series of steps of successively higher temperatures with a final step utilizing oxygen atmosphere and a temperature above the decomposition temperature of the compound MgOH2. The amount of water vapor evolved at each step is then measured and the amount of OH present can be calculated. NASA

N70-34654# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE DIRECT SYNTHESIS OF ORGANIC DERIVATIVES OF SILICON USING NON-HALOGENATED ORGANIC COMPOUNDS. THE VIBRATIONAL SPECTRA OF SOME TRIALKOXYSILANES. THE PROTON NUCLEAR MAGNETIC RESONANCE SPECTRA OF SOME TRIALKOXYSILANES
W. E. Newton and E. G. Rochow Nov. 1969 57 p refs
(Contract ARPA-SD-88)
(AD-701762; ARPA-TR-38) Avail: CFSTI CSCL 7/3

Some trialkoxysilanes and tetraalkoxysilanes were prepared directly by the reactions of the appropriate primary alcohol with a silicon-copper contact mixture. Similar attempts with secondary and tertiary alcohols, ethers, and secondary amines gave no silicon-containing products. The vibrational spectra of eight alkoxysilanes were recorded, allowing assignments of the various modes to be made. Trends observed in these spectra are discussed and compared with those found in related compounds. Nuclear magnetic resonance spectra of some trialkoxysilanes were examined, and chemical shifts and 29-silicon-proton spin-spin coupling constants were measured. The systematic trends found in these data for the silane proton in these and related compounds are thought to reflect changes in hybridization of the silicon-hydrogen bond. A correlation is attempted between these data and the frequency of the silicon-hydrogen stretching vibration in the vibrational spectra. Author

N70-34688# Oak Ridge National Lab., Tenn.
REVIEW OF THE ADSORPTION OF IODINE ON METAL AND ITS BEHAVIOR IN LOOPS
E. Hoinkis May 1970 68 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2916) Avail: CFSTI

The partial pressures of the iron iodides at equilibrium with solid FeI2 in the system Fe–I were calculated for the regions where the solid phases are Fe(s) and Fe(s) + FeI2(s) as function of temperature and pressure. The investigations of iodine adsorption on metal surfaces and of iodine deposition in loops was reviewed. The methods used and the results of the experiments are discussed with respect to the behavior of iodine in coolant circuits of helium-cooled, graphite-moderated reactors. Author (NSA)

N70-34716*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
MICROSCOPIC REVERSIBILITY FOR RATES OF CHEMICAL REACTIONS CARRIED OUT WITH PARTIAL RESOLUTION OF THE PRODUCT AND REACTANT STATES
James L. Kinsey 4 Jun. 1970 50 p refs
(Grant NGL-50-002-001)
(NASA-CR-109947; WIS-TCI-389) Avail: CFSTI CSCL 07D

Applications of the principle of microscopic reversibility are considered for rates of reactions measured in experiments that reveal some of the dependence on the rotational, vibrational, and/or translational states of the reactants or products. Each type of measurement establishes a characteristic set of quantum states for the reactants and products, suggesting the removal of trivial statistical factors (densities of states) from the data to retrieve a purely dynamical quantity omega (E), the state-to-state reaction rate suitably averaged over the initial and final sets of states at fixed total energy E. This quantity is fully symmetric with respect to the direction of the reaction—either the forward or reverse rate coefficient can be obtained by multiplying omega with the proper density of final states. Thus omega reflects the intrinsic probability of the process, disregarding the statistical bias introduced by the nature of the experiment itself. Methods of accurate computation of state-densities appropriate to several kinds of detailed kinetic measurements currently feasible are given. Author

N70-34763# Sandia Corp., Albuquerque, N. Mex.
MICROSYNTHESIS OF TRITIATED PARAPOLYPHENYL WITH A VERY HIGH SPECIFIC ACTIVITY
J. M. Peters et al. 13 Apr. 1970 10 p refs Transl. into ENGLISH from J. Labelled Comds. (Brussels), v. 5, no. 1, Jan.–Mar. 1969 p 72-79
(SC-T-70-4014) Avail: CFSTI

The parapolyphenyl (C6H4)n presents a great thermal and molecular stability (benzene ring), allied to a high hydrogen content. These characteristics justify an attempt at tritiating this polymer to a very high specific activity. Thus tritiated, the latter may lend itself

as being utilized as a target for the production of 14-MeV neutrons in small accelerators. Two microsyntheses were undertaken, leading to specific activities of 17 and 31 Ci/mM. The isotopic yields and autoradiolysis of these polymers were tested and evaluated.
Author (NSA)

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-33408# Weapons Research Establishment, Adelaide (Australia).
IONOSPHERIC DATA FOR APRIL 1969 FROM SALISBURY, SOUTH AUSTRALIA
Feb. 1970 28 p
(SAD-1969/4(S)) Avail: CFSTI

Tables of the hourly values of the ionospheric parameters are given for the station at Salisbury, Australia for April 1969. The data include values for fbEs, fEs, FOE foF2, fxI, fmin, h'Es, h'F, M(3000)F2, and M(3000)I.
Author

N70-33414# Technische Hogeschool, Eindhoven (Netherlands).
THE SCALAR FEED
J. K. M. Jansen, M. E. J. Jeuken, and C. W. Lambrechtse 20 Nov. 1969 60 p refs
(TH-70-E-12) Avail: CFSTI

The electromagnetic field in the grooves of a corrugated conical horn antenna were investigated by modifying the boundaries of the grooves in such a way that they coincided with the spherical coordinate system. The conditions under which the electrical and magnetic fields are zero at the opening of the grooves are found, because in that case a symmetrical radiation pattern is obtained. Under the condition that the width of the grooves is small compared with the wavelength, the dominant mode is a TM-mode and the depth of the grooves should be equal for all grooves not too close to the apex of the cone and equal to a quarter of a wavelength.
Author

N70-33417# Weapons Research Establishment, Adelaide (Australia).
IONOSPHERIC DATA FOR MARCH 1969 FROM SALISBURY, SOUTH AUSTRALIA
Feb. 1970 28 p
(SAD-1969/3(S)) Avail: CFSTI

Ionospheric data is tabulated according to the hour, day, month, and station. The ionosonde has the following characteristics: frequency range 1.6 to 20.0 MHz; transmitted pulse length 60 microseconds; pulse repetition frequency 50/s; peak pulse power 3 kW; receiver bandwidth 30 kHz; frequency sweep approximately—logarithmic; recording time 18 s/record; height marker intervals 100 km; height range up to 800 km and; frequency marker intervals 1 MHz.
E.M.C.

N70-33508 British Broadcasting Corp., Kingswood (England). Research Dept.
PULSE CODE MODULATION FOR HIGH QUALITY SOUND DISTRIBUTION: QUANTIZING DISTORTION AT VERY LOW SIGNAL LEVELS
M. G. Croll 1970 6 p refs
(Rept-1970/18; EL-40) Avail: Issuing Activity

In pulse code modulation systems, distortion of very low level signals is known to occur, and in high-quality program distribution it is the most objectionable signal degradation caused by this kind of system. Subjective tests are described which show that it is necessary to use 14 bits per sample to code the audio signal in order to make this form of distortion, often called granular distortion, inaudible. However, granular distortion can be substantially eliminated by the addition of small agitating signals at the input of the system with only a slight decrease in the overall signal-to-noise ratio. It is recommended that this artifice be employed to reduce the number of bits per sample to 13.
Author

N70-33528# Weapons Research Establishment, Salisbury (Australia).
ANALYSIS OF LARGE DIPOLE ARRAYS BY DIGITAL COMPUTER
J. L. Whitrow Sep. 1969 37 p refs
(WRE-TN-ED-178) Avail: CFSTI

The gain and radiation patterns of large dipole arrays are calculated from well known expressions for the field of an isolated dipole with a sinusoidal current distribution. Formulas are developed to treat arbitrarily oriented dipoles. Image theory is used to calculate the effect of ground planes on the array.
Author

N70-33564*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO MCC/MSFN MISSION CONFIGURATION COMMAND COMMUNICATION TELEMETRY TRACKING
Edwin H. Clark Mar. 1970 191 p
(NASA-TM-X-64290) Avail: CFSTI CSCL 17B

CONTENTS:

1. COMMAND NETWORK CONFIGURATION p 1–16 (See N70-33565 18-07)
2. COMMUNICATION NETWORK CONFIGURATION p 17–33 (See N70-33566 18-07)
3. TELEMETRY LAUNCH/ORBITAL NETWORK CONFIGURATION p 34–66 (See N70-33567 18-07)
4. TRACKING NETWORK CONFIGURATION p 67–94 (See N70-33568 18-07)
5. SIMULATION NETWORK CONFIGURATION p 95–112 (See N70-33569 18-07)
6. MCC/GSFC/RS GENERAL DESCRIPTION p 113–164 (See N70-33570 18-08)
7. SPACECRAFT TELEVISION p 165–174 (See N70-33571 18-07)

N70-33565*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
COMMAND NETWORK CONFIGURATION
In its Apollo MCC/MSFN Mission Configuration Command Commun. Telemetry Tracking Mar. 1970 p 1–16 (See N70-33564 18-07)
Avail: CFSTI CSCL 17B

The Apollo universal command system, which provides a means of transmitting data and other information required for command purposes is briefly described. The operations of the command load routing from the real time computer complex to the communication, command, and telemetry system are outlined, and the activities of the Goddard Space Flight Center are mentioned. Details are given on the remote site processing and storage, and the execute command request/computer execute functions.
N.E.N.

N70-33566*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
COMMUNICATION NETWORK CONFIGURATION
In its Apollo MCC/MSFN Mission Configuration Command Commun. Telemetry Tracking Mar. 1970 p 17–33 (See N70-33564 18-07)
Avail: CFSTI CSCL 17B

The NASCOM network facilities and operations are described. The data flow and switching operations are outlined, and long-haul communications provisions are included. The activities are summarized for the tracking and data acquisition networks, Manned Space Flight Network, Kennedy Space Center, Marshall Space Flight Center, Mission Control Center, and the Apollo range instrument aircraft. N.E.N.

N70-33567*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TELEMETRY LAUNCH/ORBITAL NETWORK CONFIGURATION
In its Apollo MCC/MSFN Mission Configuration Command Commun. Telemetry Tracking Mar. 1970 p 34–66 (See N70-33564 18-07)
Avail: CFSTI CSCL 09F

The telemetry network equipment and operation are described for communication from launch, through flight and lunar exploration, and to splashdown. The data downlinks, data acquisition synchronization and conversion, launch data system/KSC, Goddard Space Flight Center, Mission Control Center, Huntsville Operation Support Center data processing, and Apollo range instrumentation aircraft are briefly discussed. N.E.N.

N70-33568*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TRACKING NETWORK CONFIGURATION
In its Apollo MCC/MSFN Mission Configuration Command Commun. Telemetry Tracking Mar. 1970 p 67–94 (See N70-33564 18-07)
Avail: CFSTI CSCL 17I

The C-band and unified S-band radar tracking requirement capabilities are listed for the network stations and Apollo ship. The data transmission operations and the mission configuration are mentioned. N.E.N.

N70-33569*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SIMULATION NETWORK CONFIGURATION
In its Apollo MCC/MSFN Mission Configuration Command Commun. Telemetry Tracking Mar. 1970 p 95–112 (See N70-33564 18-07)
Avail: CFSTI CSCL 17B

The simulation data flow and network capabilities are outlined. The equipment and operations are described. N.E.N.

N70-33571*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACECRAFT TELEVISION
In its Apollo MCC/MSFN Mission Configuration Command Commun. Telemetry Tracking Mar. 1970 p 165–174 (See N70-33564 18-07)
Avail: CFSTI CSCL 17B

The color TV network capabilities are outlined. The Goldstone, Australian, and Madrid sites are mentioned, and the TV routing and distribution at the Manned Spacecraft Center are described. N.E.N.

N70-33604# Joint Publications Research Service, Washington, D.C.
SOVIET ANTENNA STUDIES
7 May 1970 12 p refs Transl. into ENGLISH from Russian publications
(JPRS-50474) Avail: CFSTI

CONTENTS:

1. ANTENNAS OF THE FUTURE A. Pistolkors p 1–6 refs (See N70-33605 18-07)

2. STATION ANTENNA SYSTEM A. F. Bogomolov et al p 7–10 ref (See N70-33606 18-07)

N70-33605# Joint Publications Research Service, Washington, D.C.
ANTENNAS OF THE FUTURE
A. Pistolkors *In its* Soviet Antenna Studies 7 May 1970 p 1–6 refs Transl. into ENGLISH from Radio (Moscow), Mar. 1970 p 19–20 (See N70-33604 18-07)
Avail: CFSTI

A description of a phased antenna array system is presented. The phased array consists of half-wave dipoles separated from each other lengthwise and crosswise by half a wave filling the plane of the antenna. In the middle of the dipole, there is a phase shifter, controlling the phase of the oscillations received or emitted by the dipole. The advantages and disadvantages of the system are discussed in relation to the existing antennas. J.M.C.

N70-33606# Joint Publications Research Service, Washington, D.C.
STATION ANTENNA SYSTEM
A. F. Bogomolov et al *In its* Soviet Antenna Studies 7 May 1970 p 7–10 ref Transl. into ENGLISH from Antenny (Moscow), no. 5, 1969 p 3–5 (See N70-23604 18-07)
Avail: CFSTI

The basic radio engineering specifications of the TNA-57 antenna system of the Orbita stations are reviewed. Author

N70-33624# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
[RADIO WAVE PROPAGATION AND UTILIZATION IN THE VERY LOW RADIO FREQUENCIES] Final Technical Report, 1 Jul. 1957–30 Jun. 1967
J. A. Pierce Apr. 1970 23 p
(Contract Nonr-1866(07))
(AD-705523; TR-606) Avail: CFSTI CSCL 17/2

The research was primarily in the area of radio wave propagation and utilization in the very low radio frequencies. Because the utility of VLF transmissions for standard frequency comparisons and for radio aids to navigation was recognized at about the beginning of this contract, much of our effort and much of the following report deals with these matters of utilization. It is believed that discovery and dissemination of facts learned under this contract has already lead to practical advances of great importance; notably the network of high precision frequency comparisons between the various standards laboratories throughout the world, and the Omega system of navigation which is just coming into operation. Author (TAB)

N70-33728# Environmental Science Service Administration, Boulder, Colo. Research Labs.
CONCERNING THE THEORY OF SCATTER OF HF RADIO GROUND WAVES FROM PERIODIC SEA WAVES
James R. Wait Dec. 1969 16 p refs
(ESSA-ERL-145-OD-3) Avail: SOD $0.30

A theory is presented for the bistatic or oblique scattering of high-frequency radio ground waves by a gently rippled surface. This constitutes a generalization of an earlier treatment of the backscatter. It is shown that the effect of the obliquity is to shift the scattering resonances to higher radio frequencies. The associated Doppler effects are also discussed. Finally, a number of conjectures are made concerning the applicability of the results to oceanographic studies. Author

N70-33785*# National Aeronautics and Space Administration, Washington, D.C.
A HYPER-WIDEBAND MICROWAVE ANTENNA
Tokio Sakurai Jul. 1970 24 p refs Transl. into ENGLISH from Denki Tsushin Gakkai Zasshi (Japan), v. 38, 1955 p 10–18
(NASA-TT-F-13071) Avail: CFSTI CSCL 09E

The described antenna structure is such that microwaves fed by a waveguide are passed through a flat bent tube for

conversion into conical waves, which are then projected through a trumpet opening to a parabolic cylindrical reflector; the reflected electric waves are sent out in an oblique frontal direction with strong directivity, irrespective of their frequency. The reflected waves created in this process scatter after hitting the walls of the flat tube and cannot go backward into the opening of the waveguide, and therefore, VSWR is very fine. When the directivity and gains were measured in the 4000 Mc and 9400 Mc bands, the results were almost ideal. It was observed that if the emission opening of the antenna is designed as a 3 meter square, VSWR could be kept under 1.05 over a hyper-wideband zone ranging approximately from 3500 Mc to 10000 Mc, and the gain would be nearly 40 db even at 3500 Mc. Author

N70-33791*# Michigan Univ., Ann Arbor. Willow Run Labs.
RADAR DATA COLLECTION MISSION, ADDENDUM Final Report
R. A. Rendleman Jun. 1970 13 p
(Contract NAS9-10211)
(NASA-CR-108500; WRL-3261-1-F1-Add) Avail: CFSTI CSCL 17I

Some of the useful information available in radar images is demonstrated. Observations on data gathered at Lawrence, Kansas with and without ground truth are presented. It is concluded that changes of intensity and texture of fields, when observed repeatedly, can contribute to a history of field operations which would be significant in understanding the agricultural situation. Author

N70-33797# Institute for Telecommunication Sciences, Boulder, Colo.
ATMOSPHERIC PROPAGATION PROPERTIES IN THE 10 TO 75 GHz REGION: A SURVEY AND RECOMMENDATIONS
H. J. Liebe Sep. 1969 34 p refs
(ESSA-TR-ERL-130-ITS-91) Avail: SOD $0.40

The expansion of telecommunication services into the millimeter wave region prompts a careful look at the limitations of the atmosphere that can give rise to severe signal degradations. In Part I the loss and scatter mechanisms in the 10- to 40-GHz range are examined. It is concluded that there is a need for further theoretical and experimental work on the atmospheric propagation properties in order to support the engineering efforts in designing reliable, useful systems. In Part II the discussions are extended to the 40- to 75-GHz region where absorption by oxygen dominates. In this region, communication through the atmosphere is not practical; however, the oxygen absorption has a great potential for remote sensing of atmospheric variables, and for special (short-range communication) applications. Unsolved problems of the propagation medium are discussed as a basis for formulating proposals; and the objectives of an experimental program for studying oxygen dispersion and absorption are given. Author

N70-33799# Environmental Science Services Administration, Colo. Research Labs.
SCALED MODEL MEASUREMENTS ON A TRANSPORTABLE LOG PERIODIC DIPOLE ANTENNA
E. L. Kilpatrick and H. V. Cottony Dec. 1969 203 p refs
(ESSA-TR-ERL-141-ITS-96) Avail: SOD $1.75

A horizontally polarized, HF, log-periodic antenna was investigated experimentally. The antenna is supported by a single mast 22.9 m high and three ground anchoring points. Its operating frequency range is 4 to 30 MHz. A scaled model using 32:1 factor was constructed and tested. Radiation patterns were measured through 360 deg in azimuth, from 5 deg to 60 deg elevation angles in 5 deg increments, at 14 frequencies. Power gains were measured at three frequencies. Except at the lowest frequency, the antenna was found to be moderately directive, with approximately 11-dB front-to-back ratio, and 7-dB horizontal-to-vertical polarization ratio. Power gain ranged between 5.6 and 8.4 dB. Author

N70-33800# Institute for Telecommunication Sciences, Boulder, Colo.
MUTUAL IMPEDANCE OF LOOP ANTENNAS OVER FINITELY CONDUCTING GROUND
J. Ralph Johler Jul. 1969 114 p refs
(ESSA-ERL-122-ITS-86) Avail: SOD $1.00

Ground conductivity can be deduced by measuring the mutual impedance of loops. Special orientations between a pair of loops and between the loops and the ground are sensitive to the electrical constants of the ground. The inhomogeneities in the ground also affect the loop current measurement. This technique is especially useful when the loops are separated by distances that are small compared with a wavelength. This paper presents a computation procedure and some LF, MF, and HF calculations. A computer program is given for further calculations, and the effect of ground stratification, ground conductivity, and ground dielectric constants are considered. A loop orientation in which one loop has an axis parallel to the ground and the other has an axis perpendicular to the ground is found to be more sensitive to the ground electrical constants. Comparative calculations are given for various orientations of loops to illustrate the conductivity and frequency dependence. Author

N70-33801# Environmental Science Services Administration, Boulder, Colo. Research Labs.
A NOTE ON NOISE FACTOR MEASUREMENT
E. G. Hildner Oct. 1969 98 p refs
(ESSA-TR-ERL-133-WPL-9) Avail: SOD $1.00

The definition of noise factor, F, is reviewed, and the mathematical bases for several methods of measuring noise factor are presented. Error analyses are given to determine: (1) the noise source temperatures, which minimize the noise factor measurement error; (2) an analytic expression for the expected error as measured by the CW Method; and (3) an analytic expression for the expected error as measured by the Y-Factor Method. A hypothetical receiver is used as a comparative example to evaluate the errors to be expected as measured by the CW Method and by the Y-Factor Method. The importance of bandwidth as a criterion of receiver performance is stressed. The effect on the measured F produced by a change in receiver gain-bandwidth produce is considered briefly. A preliminary calculation of the source temperatures actually seen by the receiver input completes the report. Author

N70-33807# Institute for Telecommunication Sciences, Boulder, Colo.
RAIN ATTENUATION STUDY FOR 15 GHz DESIGN Final Report
R. E. Skerjanec and C. A. Samson May 1970 61 p refs
(Contract FA-65-WAI-86)
(FAA-RD-70-21) Avail: CFSTI

A comparison was made between 10 GHz and 14.43 GHz microwave relay performance in northeastern Mississippi from February to May 1969. Interference fading caused by atmospheric multipath did not exceed 15 dB on either system, but as much as 48 dB attenuation was observed at 14.43 GHz during heavy rain. Rainfall rate on the 4.67 km (3 mi) test path was obtained from 20 tipping-bucket gages. A method of estimating rain attenuation for relay design and reliability problems is presented and general storm rainfall information is included. Author

N70-33912# Naval Submarine Medical Center, Groton, Conn. Medical Research Lab.
AN EVALUATION OF THREE METHODS FOR UNSCRAMBLING HELIUM SPEECH PRODUCED AT DEPTHS OF 800 AND 1000 FEET Interim Report
Joseph S. Russotti and Joseph R. Duffy 30 Oct. 1969 11 p
(AD-705410; SMRL-602) Avail: CFSTI CSCL 17/2

Three systems for unscrambling helium speech produced at simulated depths of 800 and 1000 feet were evaluated.

Recordings of the modified rhyme test read by an experienced male diver in a pressurized helium atmosphere were processed through three commercial frequency-shifting devices. The intelligibility of words passed through these systems was compared to scores obtained when the same helium recording was presented directly without alteration and when presented at one-half playback speed to groups of listeners. A within-subjects design was employed with suitable counterbalancing so that no word was heard twice by the same listener. Author (TAB)

N70-33977# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING, VOLUME 9, NO. 9, 1965
E. M. Goldovskii et al 25 Mar. 1970 71 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 9, no. 9, 1965 p 21–28, 42–59
(AD-705752; FTD-MT-24-14-70) Avail: CFSTI CSCL 17/2

Contents: From the superscope to the techniscope; Discharge time of a structural phototarget of a vidicon; Nonsynchronous filming from a screen of a kinescope; Method of video signal delay with the help of a vidicon; Magnetic storage units of information in a small-frame television. TAB

N70-33981*# TRW Systems Group, Redondo Beach, Calif. Electronics Systems Lab.
COMMUNICATIONS STUDY FOR THE PARTICLES AND FIELDS LUNAR SUBSATELLITE
L. A. Lorio 21 May 1970 29 p refs
(Contract NAS9-8166)
(NASA-CR-108502; TRW-11176-H546-R0-00) Avail: CFSTI CSCL 17B

The modulation losses, margin calculations, predetection signal spectrum, and carrier acquisition for the downlink communications system are described. The modulation loss are determined for both sine wave and square wave subcarrier for comparison. A 32.768 kHz square wave subcarrier is to be biphased, modulated with 128 bps data, and then phase modulated onto the 2282.5 MHz carrier. The percentage of total power is given for the subcarrier at various values of the phase modulation index. Carrier channel margins are determined, and the phase shift keying method is expected to provide information channel margins approximately 4 dB better than for the frequency shift keying technique for the same system parameters. N.E.N.

N70-34064*# New Mexico State Univ., Las Cruces.
ADVANCED STUDY OF VIDEO SIGNAL PROCESSING IN LOW SIGNAL TO NOISE ENVIRONMENTS: MULTI-FILTER PHASE-LOCKED LOOP DEMODULATION Quarterly Progress Report, Feb. – May 1970
Frank Carden and Enrique Cheng May 1970 77 p refs
(Grant NGR-32-003-037)
(NASA-CR-109886) Avail: CFSTI CSCL 17B

The carrier model and the model for the generalized multi-filter phase-locked loop are considered, and state equations for the phase model are derived. Analog computer configuration showing direct component interconnections for simulations of both carrier and phase multi-filter phase-locked loop models are also obtained. Simulations of a low-band pass multi-filter phase-locked loop, with a single deterministic sinusoidal frequency modulated sub-carrier were performed to investigate the improvement of the low-pass phase-locked loop due to the band-pass filter. This improvement was measured by comparing the phase error of the low-band pass multi-filter phase-locked loop with the resulting low-pass phase-locked loop when the band-pass filter was removed from the loop. The simulation was accomplished by solving the state equations for the phase model on a CDC 3300 digital computer, using a numerical integration technique, and by analog computer simulation of the carrier model showing direct component interconnections. Author

N70-34107# Adelaide Univ. (Australia). Dept. of Physics.
THE ADELAIDE RADIO-METEOR SYSTEM
W. Graham Elford *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 11–28 refs (See N70-34106 18-20)
Avail: CFSTI

A 27-MHz combined cw and pulse radio system for comprehensive observations of meteor trails is described. The equipment affords measurements of systematic and turbulent wind and meteor orbits on a routine basis. The physical principles underlying these measurements are discussed and the main features of the equipment described. Author

N70-34108# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE METEOR RADAR NETWORK AT HAVANA, ILLINOIS
Mario D. Grossi *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 29–37 (See N70-34106 18-20)
Avail: CFSTI

The described eight station phase coherent radar network collects meteor echoes from a volume in the upper atmosphere for one-dimensional as well as three-dimensional wind determination. The latter system uses meteor trail echoes received concurrently at the main site and two remote sites for correlating range, angle of arrival, Fresnel patterns, and Doppler information. Digital wind pattern reconstruction is performed by evaluating the hourly 2,000 samples of one-dimensional wind velocity measurements, and the 100 an hour and 200 per hour, respectively, samples of two- and three-dimensional data. G.G.

N70-34109# Indatacon Corp., Marlboro, Mass.
THE AFCRL PULSE DOPPLER RADAR FOR THE DETERMINATION OF WINDS AND DENSITY FROM METEOR TRAILS
William H. Ramsey and Robert F. Myers (AFCRL, Bedford, Mass.) *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 39–65 refs (See N70-34106 18-20)
Avail: CFSTI

The design of a 40-kW, 36.8/73.6 MHz pulse Doppler radar for the determination of winds and density from meteor trails in the 80 to 105 km region is presented. The set utilizes a 40 microsecond pulse at a pulse repetition frequency of approximately 500 pulses per second. The meteor trail information may be displayed on oscilloscopes and photographed for manual interpretation. Additionally, the data are processed by a small computer on a pulse-by-pulse basis for each trail and the derived information stored on magnetic tape for further data processing. Author

N70-34110# Stanford Univ., Calif.
THE STANFORD UNIVERSITY SYSTEM, 2
Robert Nowak *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 69–81 ref (See N70-34106 18-20)
Avail: CFSTI

Outlined is a coherent pulse Doppler radar system that measures atmospheric density and wind height by comparing transmitted frequency with a small shift in the received frequency signal; thus, receding meteor trails lead to a lower frequency and approaching ones to to higher frequency. Echo decays are established from wind velocity recordings in the meteoric height region. The altitude of the reflecting trails are deducted from decays of recorded echo amplitudes. G.G.

N70-34111# Stanford Univ., Calif.
THE STANFORD UNIVERSITY SYSTEM, 1
Allen M. Peterson *In* AFCRL Proc. of the Workshop on Methods

of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 67-68 (See N70-34106 18-20)
Avail: CFSTI

Described is the design of a pulse Doppler radar system with high duty cycle operation that uses a 2-msec pulse interval in which to measure meteor echoes. A low peak power coded-pulse train is utilized to achieve a sensitivity equivalent to a 70-kW single 10- microsecond pulse. The completed system will use a composite pulse, with half the power in a simple long pulse and half of it in the phase-coded range pulse. The aim is a low peak power system of about 500 watts that will give several hundred digitally recorded meteor echoes per hour. G.G.

N70-34112# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
A CONTINUOUS WAVE RADAR FOR IONOSPHERIC WIND MEASUREMENTS Summary
Issac Revah and A. Spizzichino *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 83-91 refs (See N70-34106 18-20)
Avail: CFSTI

Ionospheric winds are determined by continuous wave radar measurements of meteor trail drifts. Phase differences between the fields received on three different antennas are used to deduct azimuth and elevation of the echo. Three frequencies transmitted simultaneously are used for distance measurements. From individual wind velocities, measured at different heights and times, a time cross section can be interpolated. Accurate height measurements are obtained through: (1) density measurements at ionospheric levels by echo decay; and (2) comparison of wind profiles with the altitude of occurence of E sub s layers, as observed by an iosonde in the same region. G.G.

N70-34113# Sheffield Univ., (England).
THE SHEFFIELD UNIVERSITY SYSTEM
Heinz G. Mueller *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 93-100 (See N70-34106 18-20)
CFSTI

A coherent-pulse radar system has been developed at Sheffield to measure the Doppler shift of meteor echoes caused by the bodily motion of meteor trains. Some 70,000 individual echoes recorded in 18 months have been analysed so far to obtain the regular prevailing and periodic tidal components of the upper atmospheric wind system, and the seasonal variations in these components have been established. The Doppler technique employed in the present investigation has also been used to resolve wind velocity gradients.

N70-34116# Stanford Univ., Calif.
ACCURACIES FOR THE STANFORD SYSTEM
Robert Nowak *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 ref p 131-138 (See N70-34106 18-20)
Avail: CFSTI

First order error effects are considered in determining the accuracy of the system for digitally recording meteor echoes. The system relates height and echo decay at high elevation angles and uses this decay height to obtain the height of winds measured at low elevation angles. Errors induced by noise and errors that result from quantization as the data are digitized for recording are analyzed. A short description of station parameters and expected signals is also given. It is shown that the errors from quantization of data actually limits the accuracy of the system. J.M.C.

N70-34143# Naval Postgraduate School, Monterey, Calif.
AN ADAPTIVE DECISION PROCESS
Joseph Maris Moroney (M.S. Thesis) Dec. 1969 33 p refs
(AD-706005) Avail: CFSTI CSCL 9/4

The thesis investigates a decision process which is designed to employ multiple observations in an optimal manner as a means of solving a signal detection problem. The characteristic of this decision process is that it permits the decision-maker to defer his detection decision until new data is obtained from the next observation and to weigh the new data with an opinion based on previous data. The effect of adapting a decision to the results of previous observations is seen to be similar to learning process which is taking place over a length of time. Since the decision process may involve relatively lengthy periods of time an estimator of this time is developed. Lastly, the decision model is seen to provide a model by which human detection behavior may be evaluated. Author (TAB)

N70-34193# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SHARPNESS OF AN IMAGE TRANSMITTED BY STROBOSCOPE TO AN IMAGE ORTHICON
G. N. Gryazin Mar. 1970 15 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniga (USSR), v. 12, no. 11, 1968 p 69-71
(AD-705787; FTD-MT-24-343-69) Avail: CFSTI CSCL 17/2

Given are correlations determining the sharpness drop of the transmitted image boundaries of a fast moving object and taking into consideration storage and memory characteristics of the superorthicon in the standard scanning. Presented are the results of experimental investigation of a system on the tube LI-17 for the cases of lighting an object by a pulse light source continuous in time. Author (TAB)

N70-34280*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TRANSMISSION CHARACTERISTICS OF SPLIT-PHASE PCM CODES
B. H. Batson 25 Nov. 1969 36 p
(NASA-TM-X-64309; EE69-2003(U)) Avail: CFSTI CSCL 09F

The autocorrelation function and power spectral density of an RF carrier which is modulated by a split phase PCM code are investigated. Results indicate that the spectral occupancy is greater for a carrier which is frequency modulated by a split phase code than for carriers which are amplitude or phase modulated by that code. The spectral occupancy of the frequency modulated carrier depends on the frequency deviation due to the PCM code or on the frequencies which are keyed between by the code. The spectral occupancy for the AM case is the same as that for the PM case. The baseband PCM code spectrum is translated to appear about plus and minus the carrier frequency. A discrete carrier component is always present for the AM case, while it is possible in the PM case to convert all of the available channel power into sideband power. It is concluded that PM is inherently a more efficient technique than either AM or FM for translation of a random split phase PCM code, and that PCM is the most general case and the AM and PM cases are actually degenerate forms. Author

N70-34380# Harvard Univ., Cambridge, Mass. Cruft Lab.
ANTENNAS WITH TRANSMISSION-LINE INTERCONNECTIONS
Ronold W. P. King and Sheldon S. Sandler Nov. 1969 28 p refs
(Contract F19628-68-C-0030; Grant NSF-GK-3800)
(AD-705189; AFCRL-69-0525; SR-5) Avail: CFSTI CSCL 9/5

Arrays of cylindrical dipoles and monopoles are usually driven by means of interconnecting transmission lines, whereas analyses of such arrays are generally made in terms of currents or voltages with assigned relative amplitudes and phases at the individual input terminals. Moreover, it is commonly assumed that the distributions of current along all elements are the same and without phase variation. In this report the properties of broadside and endfire arrays are treated with full consideration of interconnecting

transmission lines and the effect of mutual coupling on the distributions of current. Driving-point admittances and field patterns of arrays of half-wave and full-wave elements are given. A novel broadside-endfire array is described. Author (TAB)

N70-34440*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATION PATTERN CALCULATIONS FOR AN ATS-F 48-PANEL DEPLOYABLE-REFLECTOR ANTENNA
R. Miezis (Computer Appl., Inc.) and R. F. Schmidt Jun. 1970 42 p refs
(NASA-TM-X-63984; X-525-70-231) Avail: CFSTI CSCL 09E

Far-field radiation patterns are computed for a deployable-reflector antenna composed of N' panels which are, ideally, sections of parabolic cylinder. The vector Kirchhoff diffraction method (physical-optics) is applied at the antenna surface, and integration is accomplished by digital computer to obtain the backscattered radiation patterns. Surface normals are found for indexed parabolic cylinders and distorted versions of this design structure approximating a paraboloid of revolution. It is shown that one of the methods evolved for a thermally distorted reflector is adaptable to the case when the assumption of straight lines on the metallized reflector mesh between supporting ribs is not justified. Author

N70-34443# Hawaii Univ., Honolulu.
ENCODING AND DECODING CYCLIC CODE GROUPS Scientific Interim Report
Norman Abramson Oct. 1970 26 p refs
(Contract F44620-69-C-0030; AF-AFOSR-1251-67; Proj. Themis)
(AD-701772; A69-8; AFOSR-70-0465TR) Avail: CFSTI CSCL 9/4

It is shown that the product of two cyclic codes with block lengths relatively prime can be described in terms of two interlaced codes. An improved characterization of the generating polynomial of the product code is provided in terms of the generating polynomials of the two original codes. It is shown that the product code and seven other codes related to the product code (called a code group) can all be obtained from four canonical polynomials which may be calculated using the Euclidean Algorithm. These results then lead to simple encoder realizations for cyclic code groups and to a decoding algorithm, called cascade decoding. Author (TAB)

N70-34446*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATMOSPHERIC EFFECTS ON MILLIMETER WAVE COMMUNICATION CHANNELS
Erwin Mondre Mar. 1970 45 p refs
(NASA-TM-X-63985; X-733-70-250) Avail: CFSTI CSCL 17B

The feasibility of using the millimeter wave region for future earth to space communication needs is discussed. A variety of atmospheric conditions and the reliability of the space diversity techniques used for their detection are included. Characterization and measurement of the performance parameters describing the communication channel are discussed. Author

N70-34511*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
POSTFLIGHT ANALYSIS OF APOLLO 6 RADAR TRACKING DATA
Richard K. Osburn 13 Sep. 1968 22 p refs
(NASA-TM-X-64389; MSC-68-FM-226) Avail: CFSTI CSCL 17I

Postflight analyses of Apollo 6 radar tracking data were made to verify the unified S-band (USB) orbit determination capabilities and evaluate Manned Space Flight Network (MSFN) performance. Initial studies attempted to obtain the best possible estimate of the Apollo 6 trajectory. As a result of these studies, a serious anomaly in Ascension C-band range data was discovered and is now being corrected. Also noted were unexpected perturbations in the CSM trajectory. These were found to be the result of water boil-off, and it was concluded that the water boiler could seriously affect future missions. Comparisons of C-band and USB orbit determination results showed excellent agreement between the two systems. Evaluation of vectors showed deviations greater than preflight error analyses had predicted. These were the results of the poor quality of the Ascension range data and the effects of water boiler venting. Author

N70-34526*# TRW Systems Group, Redondo Beach, Calif.
THE COMBLINE FILTER AND PHASE-LOCK LOOP. A NEW TECHNIQUE TO IMPROVE FM TELEVISION RECEPTION
F. M. Stuber and M. Y. Huang May 1970 120 p refs
(Contract NAS9-10204)
(NASA-CR-108506; TRW-TR-7322.03-04) Avail: CFSTI CSCL 17B

The purpose of the program, therefore, was to study and implement combline filters, to analyze their effectiveness, to develop a combline filter phase-lock loop combination, and to test its merits in the laboratory. Various techniques to realize combline filters were investigated and extensive studies prompted implementations of an analog scheme that is based on a filter loop with delayed feedback. Experimental and analytical studies revealed and explained the effectiveness of these filters in rejecting noise between the TV signal bands. Furthermore, a PLL demodulator with the combline filter as the loop filter was built and analyzed extensively and the analysis indicated significant output SNR and threshold improvement. This was subsequently demonstrated experimentally for tone-modulated signals. Author

N70-34663*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WIDE-BAND DOUBLER AND SINE WAVE QUADRATURE GENERATOR Patent Application
Robert B. Crow, inventor (to NASA) Filed 23 Dec. 1969 15 p
(Contract NAS7-100)
(NASA-Case-NPO-11133; US-Patent-Appl-SN-887685) Avail: CFSTI CSCL 09E

A wide-band signal quadrature and second harmonic generator comprise a voltage controlled phase shifter which provides an output representing a phase shifted sine input signal. The input signal and the phase shifter's output are multiplied by a multiplier whose output, after integration, is used to control the illumination levels of photoresistors in the phase shifter so that the output of the phase shifter is the cosine of the sine input signal. The multiplier's output when phase lock is achieved is the second harmonic of the sine input signal. The photoresistors in the phase shifter have large dynamic ranges of resistance changes to enable the generator to operate over a wide-band of input signal frequencies. NASA

N70-34700*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SIGNAL PHASE ESTIMATOR Patent Application
Stanley Butman, inventor (to NASA) Filed 19 Jan. 1970 21 p
(Contract NAS7-100)
(NASA-Case-NPO-11203; US-Patent-Appl-SN-3696) Avail: CFSTI CSCL 09E

The invention relates to a phase estimator particularly adapted for estimating the phase of a square wave in white noise used in a sequential ranging system for locating distant spacecraft. More particularly it relates to an apparatus for estimating the amplitude and sign of the phase difference or time delay between a first signal and a second signal. The phase or time delay of one nonsinusoidal periodic signal relative to another nonsinusoidal periodic signal is approximated, where the second signal is of the same form and frequency as the first signal, by correlating the one signal with a replica of the other to produce a first low-pass filtered correlation signal, and correlating the one signal with a replica of the other delayed one-quarter period to produce a second low-pass

filtered correlation signal. The two correlation signals are then combined in a nonlinear manner to provide a signal proportional to the desired time delay estimate according to an equation. NASA

N70-34739*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO SLOW SCAN TV TRANSMISSION TESTS OVER COMMERCIAL LONG LINES
Matthew J. Quinn, Jr. 2 Feb. 1967 55 p refs Program Apollo Working Paper No. 1216
(NASA-TM-X-64406) Avail: CFSTI CSCL 17B

The results of the Apollo Slow Scan TV transmission tests performed on November 23, 1966, between the Merritt Island Launch Area (MILA) and Houston are documented. The data collected during the tests are presented as monitor and oscillograph photographs because of the highly subjective nature of these data. Author

N70-34774# Joint Publications Research Service, Washington, D.C.
INTERFERENCE AND INTERFERENCE SUPPRESSION IN RADIO EQUIPMENT
A. Parkhomenko 22 Jul. 1970 9 p Transl. into ENGLISH from Radio (Moscow), no. 6, 11 May 1970 p 10-12
(JPRS-51003) Avail: CFSTI

The creation and use of active and passive interference in military radio electronics is discussed. Active interference is used to jam signals and to mask radio outputs so that it is impossible to separate the useful signal from the noise. A misinforming interference is not always discovered rapidly because externally it often appears as a useful signal. Selective interference is used to suppress one communication channel or one radio equipment station. Introduction of oscillating and amplifying vacuum devices makes it possible to return interference to the required frequency by voltage changes or amplification of the suppressed signal. Passive interference uses secondary radiation of a conductor to reflect incident signals. Interference suppression for radio equipment operation consists of frequency retuning in radar stations and devices for providing non-trimming entrance into communications on spare frequencies. G.G.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-33451# Naval Postgraduate School, Monterey, Calif.
AN IMPLEMENTATION OF LISP 1.5 FOR THE IBM 360/67 COMPUTER
Donald Gunn Gentry (M.S. Thesis) Dec. 1969 100 p refs
(AD-706031) Avail: CFSTI CSCL 9/2

The design and implementation of the NPS LISP programming system is described. NPS LISP is an interactive version of LISP 1.5, a sophisticated list processing and symbol manipulation computer language. NPS LISP was implemented in PL/I for operation under the CP/CMS time-sharing system on the IBM 360/67 computer. It is an interpretive system patterned after 7090 LISP. Most of the features of 7090 LISP are included in NPS LISP. TAB

N70-33515# Japan Broadcasting Corp., Tokyo. Auditory and Visual Information Processing Research Group.
CONSTRUCTION OF A COMPLEX-VALUED NONLINEAR DISCRIMINANT FUNCTION FOR PATTERN RECOGNITION
Yoshinori Uesaka Dec. 1969 39 p refs *Its* No. 131
Avail: CFSTI

A complex-valued nonlinear discriminant function (CNDF) is proposed and is based on a phi-function system obtained by generalizing the finite Walsh function to the case of many-valued variables. The CNDF can yield hypercurved decision surfaces and can recognize both binary and many-valued patterns. The construction of the CNDF from training patterns requires only a simple calculation with no storage or iteration for training patterns. The system can be modified for new training patterns or an adaptive construction. Examples are given for evaluating the CNDF classification. R.B.

N70-33570*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MCC/GSFC/RS GENERAL DESCRIPTION
In its Apollo MCC/MSFN Mission Configuration Command Commun. Telemetry Tracking Mar. 1970 p 113-164 (See N70-33564 18-07)
Avail: CFSTI CSCL 09B

Details are given on the real time computer complex and equipment associated with it. Descriptions are also presented on data routing; data distributor adapter; communications, command, and telemetry system; data modems; and remote site hardware. N.E.N.

N70-33583# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.
ELECTRICAL CHARACTERISTICS OF HARWELL 7000 SERIES DATAWAY. MULTILAYER PRINTED CIRCUIT BOARD TYPE 94/40/48-6
F. N. Hale and A. N. Thompson Jan. 1970 9 p refs
(AERE-M-2286) Avail: AEC Depository Libraries; HMSO 2s 6d; BIS $0.50

The Harwell Crates types 7005/6 ware designed to comply with the CAMAC standard. They incorporate a printed circuit board that interconnects the appropriate pins on twenty-four 86-pin edge connector sockets, defined by CAMAC, and pins on a twenty-fifth edge connector, which may be regarded as ancillary to the crate and is not defined by CAMAC. CAMAC compatible units can be plugged into any of the 24 connectors, but will not fit into the additional position associated with the 25th edge connector, the latter being designed to accept special units, such as the 0704-1, which monitors the voltage supplies to the crate. The printed circuit board is multilayered and through-hole plated. The 25 edge connectors can be fitted to it and, by wave soldering, the appropriate pins can be connected to the copper buses, lines and planes provided by the eight layers in the multilayered board. The characteristics measured on the printed circuit board without edge connectors fitted were D. C. resistence, capacitance to earth plane, and losses on power buses. NSA

N70-33597# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Electronics, Control and Instrumentation Branch.
MEASUREMENT TECHNIQUES USING A PSEUDO RANDOM BINARY SEQUENCE AND FOURIER TRANSFORMATION FOR DETERMINING A SYSTEM'S TRANSFER FUNCTION
C. B. Lawrence and A. Pearson Apr. 1970 52 p refs
(AECL-3601) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $1.50

A method for measuring the transfer function of systems associated with power reactors is described. The method lends itself to doing the measurements on-line with as little disturbance as possible to an operating system. The techniques for obtaining a good signal to noise ratio when noise is unavoidable is shown. It also shows the care that must be taken with filtering and timing to ensure good results. Author

N70-33810# Naval Postgraduate School, Monterey, Calif.
COMPUTER PROCESSING FOR DISPLAY OF THREE-DIMENSIONAL STRUCTURES
Robert Bruce Desens (M.S. Thesis) Oct. 1969 238 p refs

(AD-706010) Avail: CFSTI CSCL 9/2

The field of computer graphics applied to three-dimensional space is introduced through a discussion of perspective transformations, data structure, contour lines, and the problem of hidden-line removal. The transformation of three-dimensional coordinates into two-dimensional picture-plane coordinates is developed for twelve degrees of freedom, allowing the simultaneous movement and rotation of both the object under view and the observer. Basic concepts and requirements for the structure of data and ideas for the use of contour lines are discussed as a relative part of the field of three-dimensional computer graphics. An algorithm for the removal of hidden lines is explained for the case where the objects under view can be assumed to be constructed of bounded plane surfaces. Author (TAB)

N70-33673# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

DIGITAL FILTERS FOR ROUTINE DATA REDUCTION Final Report

H. D. Carleton Mar. 1970 46 p refs

(AD-705571; AEWES-Misc-Paper-N-70-1) Avail: CFSTI CSCL 9/4

Digital tapes produced from analog field data often carry over severe noise problems. A batch data processing capability should therefore be complemented by digital filters which can remove noise routinely. This paper describes a set of filters developed for use with Nuclear Weapons Effects Division standard data processing codes. Emphasis in assembly of the set was placed on accuracy of signal retention and on adaptability to general purpose computers. Part I discusses data which is sampled at equally spaced times, the use of sample numbers to designate time positions, and the requirement for use of a sampling frequency at least eight times greater than the highest expected signal frequency. Parts II, III, and IV document the filters of the three subroutines presently being used for noise removal. The first subroutine eliminates randomly spaced single-sample spikes through the application of inequality conditions to data. The second subroutine provides frequency filters for the removal of zero drift and single noise frequencies. Low-pass frequency filters are available in the third subroutine. Part V discusses the ten example plates used to demonstrate the filter sets effectiveness and speed of operation. Author (TAB)

N70-33720# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.

TERMTRAN: A PROGRAMMING SYSTEM FOR ENGINEERING CALCULATIONS VIA REMOTE TERMINALS, ADDENDUM

G. B. Knight and R. E. Neu 16 Apr. 1970 4 p Sponsored by AEC

(K-1735-Add) Avail: CFSTI

The differences between the presently available TERMTRAN program and the previously given description are listed. N.E.N.

N70-33733# Aerospace Corp., San Bernardino, Calif.

A VIRTUAL FOURTH GENERATION COMPUTER

E. D. Callender 24 Apr. 1970 17 p

(Contract F04701-69-C-0066)

(AD-705580; TR-0066(S9990)-1; SAMSO-TR-70-145) Avail: CFSTI CSCL 9/2

The document is a survey paper dealing with the logical form of the fourth generation computer. The notions of virtual machine, parallel structure and hierarchical construction are blended together to create such a computer. This blend results in a very powerful and flexible approach to general purpose computers. The paper briefly considers both the hardware and software implications of such a design. Author (TAB)

N70-33767# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.

REAL ENGLISH: A DESCRIPTION OF ITS OPERATION

David Klappholz Mar. 1970 23 p refs

(Contract DA-31-124-ARO(D)-352)

(AD-705651; AROD-5208-6RT Rept-70-26) Avail: CFSTI CSCL 9/2

Real English is a translator from English to a symbolic, computer-oriented language which allows its user to query a data bank in the language most natural to him. Real English was designed to operate in a time-sharing environment, in conjunction with a generalized information retrieval system. It consists of a syntactic component, which provides a string analysis of an input request, a semantic component which determines what information the user is requesting, and a command formatting component, which composes symbolic information retrieval requests of the sort accepted by the information retrieval system. Author (TAB)

N70-33783# RAND Corp., Santa Monica, Calif.

COMPUTATIONAL LINGUISTICS: BIBLIOGRAPHY, 1968

Bozena Dostert, Jean I. Houston, and Dolores V. Lofgren Jan. 1970 60 p refs

(Contract F44620-67-C-0045; Proj. RAND)

(AD-705544; RM-6223-PR) Avail: CFSTI CSCL 5/7

The report comprises an unannotated, international bibliography of 573 books, articles, and reports relevant to computational linguistics, with selective coverage in the fields of computation and programming, and social science uses of computers as language processors. In the area of linguistics, structural theory and semantics are viewed rather broadly without being exhaustive. Psycholinguistics and sociolinguistics are selectively covered, as are the structural properties of some languages, especially English and Russian. The bibliography was compiled by scanning 31 journals and semi-published reports. The listing is by subject, with an author index. Author (TAB)

N70-33803# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.

A STUDY OF NUMERICAL CONTROL SYSTEM AVAILABILITY AND MANPOWER REQUIREMENTS

George Ray Bright (M.S. Thesis—Tennessee Univ.) 28 Apr. 1970 110 p refs

(Contract W-7405-eng-26)

(Y-1721) Avail: CFSTI

A method was developed whereby managers of numerical control maintenance can make decisions to result in better continuity of operations and more efficient utilization of manpower. A data collection system was designed and applied to obtain information from which distributions of time between failure and repair time were determined. These results were utilized in a model which specified manpower levels based on the availability of the numerical control. The computed manpower levels were utilized in a second model which evaluated the effectiveness of the levels to optimize the selected manpower value. The sensitivity of the optimum value was tested to determine effects of changing conditions. This dual model procedure was proved to be applicable in determining an optimum manpower requirement. Author

N70-33819# Sandia Corp., Albuquerque, N. Mex.

SANDIA IMAGE DIGITIZER SIDCAP Report No. 2

R. K. Cover Oct. 1969 31 p refs

(SC-DR-68-812A) Avail: CFSTI

The Sandia Image Digitizer (SID) is an operational system attached to a CDC 160A computer for the purpose of scanning and converting graphical-type data into digital information. The entire digitizing process requires less than 1/4 second, and the magnetic tape output is a set of x-y coordinates describing the boundaries of the picture being viewed. The output tape is written in binary format. Author

N70-33826 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).

REPORT OF THE MATHEMATICS SECTION [BERICHT

DES SEKTOR MATHEMATIK]
In its Ann. Rept. 1969 May 1970 38 p refs In GERMAN
(See N70-33824 18-12)
(BM-39) Copyright. Avail: Issuing Activity

A new computer system was delivered and various working groups were formed to examine the accompanying software. Several discovered software errors were eliminated in cooperation with the supplier. Also developed were some service programs for special operational conditions. Transl. by G.G.

N70-33834*# Maryland Univ., College Park, Md. Computer Science Center.
A REPORT ON COMPUTER PERFORMANCE EVALUATION TECHNIQUES
James Yeh (M.S. Thesis) 1970 67 p refs
(Grant NGR-21-002-197)
(NASA-CR-109794) Avail: CFSTI CSCL 09B

Performance evaluation techniques of computer based data processing systems are reported. An overview of the analysis techniques and a review of some evaluation techniques are described, followed by dexcriptions of three analysis techniques developed in the study. Experimental results using these techniques are given. A summary and bibliography are provided. Author

N70-33885# Wolf Research and Development Corp., Riverdale, Md.
INFORMATION RETRIEVAL SYSTEM. VOLUME 2: FLOWCHARTS FOR INFORMATION RETRIEVAL SYSTEM Final Report
Jack D. Mehle, Jr. 13 Nov. 1969 261 p
(Contract DAA13-68-C-0173)
(AD-705635) Avail: CFSTI CSCL 5/2

The Fort Detrick Information Retrieval System is described in a companion document entitled - Information Retrieval System - Vol I (AD-699 387). This document contains the detailed flowcharts for the overall system. Author (TAB)

N70-33944# Georgia Inst. of Tech., Atlanta. School of Information Science.
EVALUATION OF TIME-SHARING SYSTEMS-BENCHMARKS
R. T. Adams, W. H. G. Caldwell, Jr., and D. E. Carlton 1969 41 p refs
(Grant NSF GN-655)
(PB-189621; GITIS-69-22) Avail: CFSTI CSCL 09B

Benchmarks as a tool for evaluation of time-sharing systems is reviewed. However, several other evaluation techniques are discussed, both to provide contrast to the role of benchmarking and to show that other means of evaluation can complement or increase the value of benchmarks. Emphasis is placed on advanced evaluation techniques such as simulation and mathematical models. Included in the report are sample benchmark problem runs, a literature report on standard benchmarks, and a report on benchmark practices and capabilities of the various segments of industry involved in time-sharing services and systems. Author (USGRDR)

N70-33945# Illinois Univ., Urbana. Dept. of Computer Science.
ILLIAC 3 COMPUTER SYSTEM MANUAL: INTERRUPT UNIT. VOLUME 1: LOGICAL DESIGN
Lakshmi N. Goyal and Robert M. Lansford 5 Mar. 1970 63 p refs
(Contract AT(11-1)-1018)
(COO-1018-1199-Vol-1; Rept-386-Vol-1) Avail: CFSTI

The Illiac 3 Computer is a multiprocessor computer system and consists of processors and units, interconnected by an exchange net. A schematic diagram of the Illiac 3 Computer is presented. No direct path is provided for communication from one processor to another. It is rather the job of the interrupt unit to provide for orderly transmission of messages (interrupt commands or response data) from one processor to another. The interrupt unit is essentially a store and forward message processor and synchronizes the asynchronously originating processor to processor requests. It may, however, be noted that the interrupt unit does not process the system interrupts but is only a message router. System interrupts are processed entirely in the processors themselves. Author

N70-33946# Georgia Inst. of Tech., Atlanta. School of Information Science.
DECISION TABLE MINIMIZATION
Jorge Beralt-Torrijos and Edgar M. Pass 1969 21 p refs
(Grant NSF GN-655)
(PB-189654; GITIS-69-23) Avail: CFSTI CSCL 09B

A preliminary review of the work which has been done on decision table optimization is presented. A basic algebraic formulation of the problem is introduced, and a solution based on the graphic representation of a lattice is described. A comparison of the advantages and disadvantages of the use of flowcharts and decision tables is presented. The presentation is illustrated with a simple example. Author (USGRDR)

N70-33947# Ohio State Univ., Columbus. Computer and Information Science Research Center.
A COMPUTER PROGRAM FOR THE REDUCTION OF FLOW TABLES
David W. Stevens Jun. 1969 101 p refs
(Grant NSF GN-534.1)
(PB-189679; CISRC-TR-69-16) Avail: CFSTI CSCL 09B

A sequential machine is a device whose outputs depend on both its present inputs and its past inputs. Such a device can be given a rigorous mathematical definition; a more convenient form, however, is a tabular representation called a flow table. The rows of a flow table represent the internal states of and the columns represent the inputs to a sequential machine. Each block of a flow table specifies the next internal state and an output. Frequently, an entry in a flow table is not specified, either because such a combination of state and input will not occur or because one does not care what the entry is. A flow table with such entries is said to be incompletely specified. When designing a sequential machine, one often wishes to minimize the number of internal states of the machine while preserving its input-output characteristics. USGRDR

N70-33951# Engineers Joint Council, New York.
PROCEEDINGS OF THE NATIONAL ENGINEERING INFORMATION CONFERENCE
Frank Y. Speight, ed. 1969 139 p refs Held at Washington, D.C., 24 – 25 Jun. 1969
(Grant NSF GN-819)
(PB-189505) Avail: CFSTI MF $0.65; Issuing Activity HC $6.00 CSCL 05B

The Conference was intended to foster the development of information systems particularly designed to serve engineers by focusing administrative- and management-level attention on existing engineering information resources and developing information systems. The formal sessions were devoted to: opening remarks, keynote speech, conference goals and objectives; engineering information communication problems; illustrative data, information programs, and systems in government; international programs and systems; illustrative data, information programs, and systems in the private sector; panel discussion - an evaluative overview of engineering communications; and summation. Author (USGRDR)

N70-33963# Dikewood Corp., Albuquerque, N. Mex.
A TIME-SHARING SYSTEM FOR REAL-TIME MASS PROPERTIES MEASUREMENTS
Sam D. Steerne and Glenn R. Elliott (Sandia Corp.) 1969 11 p refs Presented at the 29th Ann. Conf. of Soc. of Aeron. Weight Engr., Washington, D.C., 4 – 6 May 1970 Sponsored by AEC

(SC-DC-70-4795; Conf-700504-1) Avail: CFSTI

The system consists of a PDP-8/I computer linded to up to four vertical balance machines and up to two moment-of-inertia/center-of-gravity machines. There is a teletype station near each machine in order to allow each operator to converse independently with the computer, plus a master teletype station near the computer. A machine is controlled from its teletype keyboard, and test results are automatically typed on its teletype printer. When measurements are being made, the computer automatically acquires and processes data in real time, i.e., while the data are being generated. The teletypes operate in a time-sharing mode, i.e., an operator at one teletype station generally does not know that other stations are in use. The design and functioning of the computer time-sharing software, the design of multiple machine interfaces, and the operational characteristics of the system are emphasized. Author

N70-33996*# Wolf Research and Development Corp., Bedford, Mass.

DATA DISPLAY AND ANALYSIS

J. Meads, D. De Fanti, and P. Sweet Washington NASA Jul. 1970 48 p refs

(Contract NAS5-9756-151)

(NASA-CR-1634) Avail: CFSTI CSCL 09B

This research is addressed to the problems of developing more efficient means by which the physical scientist might intimately control the complex data processing operations involved in the analysis and meaningful interpretation of large volumes of sensor data from scientific spacecraft. On such means is handwritten input of mathematical impressions, a most natural method for making changes to data analysis procedures, and to mathematical models, while working on-line with a computer. In the work reported here, adaptive recognizers of handprinted alphanumeric characters were studied, and one of these was implemented for the purpose of detailed investigation. This character recognizer featured the facility for defining special symbols by graphical construction. The investigation explored the general problem of communication between man and computer and identified the practical problems of the character recognizer. Author

N70-34020# Massachusetts Inst. of Tech., Cambridge.

PROJECT MAC Progress Report, Jul. 1968 - Jul. 1969

1 Jul. 1969 157 p refs

(Contracts Nonr-4102(01); Nonr-4102(02); Proj. MAC)

(AD-705534; PR-6) Avail: CFSTI CSCL 9/2

The broad goal of Project MAC is experimental investigation of new ways in which on-line use of computers can aid people in their individual work, whether research, engineering design, management, or education. The document is the sixth annual Progress Report summarizing the research carried out under the sponsorship of Project MAC. Details of the research may be found in the publications listed in the Appendices at the end of the report. TAB

N70-34037# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PROGRAM FOR SOLVING A SYSTEM OF LINEAR EQUATIONS ON THE MINSK-222

L. V. Golovyashkina et al 19 Mar. 1970 28 p refs Transl. into ENGLISH from Vychislitelnye Sistemy (USSR), no. 24, 1967 p 55-75

(AD-705763; FTD-MT-24-438-69) Avail: CFSTI CSCL 9/2

The authors describe a universal program for solving a system of linear algebraic equations on a Minsk-222 computer system. The authors present the flowchart, discuss its basic features and computing time, and describe the memory configuration. TAB

N70-34047# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SIMPOLIZ 64: A LANGUAGE FOR PROGRAMMING IN SYMBOLIC NOTATIONS

E. A. Zhogolev et al 27 Mar. 1970 34 p refs Transl. into ENGLISH from Vychislitelnyi Tsentr. Sbornik Rabot (USSR), no. 9, 1967 p 66-85

(AD-705751; FTD-MT-24-02-70) Avail: CFSTI CSCL 9/2

During the 1963-64 period, a system of automatic coding POLIZ was developed at the Computer Center of MGU for use with the Setun computer. It was based on the Polish Inverse notation (Zapis) of algorithms (POLIZ) incorporating ideas advanced by the Polish mathematician Lukashevich for the bracketless writing of formulas. The present article describes the input language of such a system - SIMPOLIZ 64. It represents the Polish inverse notation in symbolic signs for which letters, numbers, and other auxiliary signs of the Setun computer are utilized. The program, specified in such an input language, is not translated into machine language but is simply represented in the ternary code retaining the Polish inverse notation. This coding is accomplished automatically by means of a special program. Consequently, the POLIZ system of automatic coding consists of the input language SIMPOLIZ, the internal language INPOLIZ, programs of automatic coding AUTOKODIR POLIZ, and the operational system POLIZ comprising an interpreter and a library of subprograms realizing the elementary operations of the systems. The outline of the essence of the Polish inverse notation is followed by a detailed description of SIMPOLIZ 64. TAB

N70-34052# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEVELOPMENT AND METHOD OF SIMULATION OF CERTAIN ALGORITHMS OF NORMALIZATION OF PLANE PATTERNS ON A COMPUTER (ETSVM)

B. V. Anisimov et al 2 Apr. 1970 23 p refs Transl. into ENGLISH from Avtomat. Upravlenie i Vychislitelnaya Tekh. (Moscow), no. 9, 1968 p 199-212

(AD-705846; FTD-MT-24-35-70) Avail: CFSTI CSCL 9/2

As the efficiency of pattern recognition is greatly enhanced by preliminary normalization (orientation, size standardization, and centering) of the test pattern, the article examines normalization procedures and algorithms with a special emphasis on orientation. Normalization of input situations eliminates a part of noise from the signal parameters. Mathematically, the pattern normalization is the finding of such an algorithm which minimizes the dispersion of parameters of realizations in the space on indicants. Orientation of a rectangle and a triangle are considered; the involved algorithm is invariant with respect to pattern size and translation. An algorithm of plane-pattern orientation based on a minimum-area circumscribed rectangle was simulated on an Ural-2 digital computer; numerals 2 and 3 written by hand in various positions on a 39 x 39-element square were tested. Operators for pattern size standardization and centering are briefly discussed. TAB

N70-34082# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.

PATTERN WIDTH AT A GIVEN ANGLE

Allen Klinger Oct. 1969 27 p refs

(Contract F44620-69-C-0030; Grant NSF-GK-4827 Proj. Themis)

(AD-701778; Themis-A69-6; AFOSR-70-0468TR) Avail: CFSTI CSCL 9/2

The paper demonstrates that the pattern feature width as a function of angle possesses several possible interpretations. The paper is a review discussing the width concept in pattern recognition and the geometrical concept itself. The object of the work is to clarify how the word description can be made precise so that computer algorithms for feature extraction may be obtained; the focus is on theoretical subject matter. The results consist of a set-theoretic definition of width-at-angle, a theorem relating it to the

pattern boundary radius vector, and a description of two alternate widths. All three widths are calculated for an illustrative example; graphical and tabular comparisons are given. Substantial variation in width-at-angle magnitude is found. The principal conclusion is that the set-theoretic width-at-angle is a useful pattern feature when it can be easily computed. Further investigation of the information contained in only part of a width function is recommended for cases where computation of width-at-angle is difficult. Author (TAB)

N70-34084# Geotech Corp., Alexandria, Va.
DIGITIZING MICROBAROGRAPH DATA Interim Report
Hal P. Demuth 9 Sep. 1969 14 p
(Contract F44620-69-C-0082)
(AD-701780; IR-69-1; AFOSR-70-0328TR) Avail: CFSTI CSCL 9/5

The report describes a technique for converting ESSA analog microbarograph data into a computer compatible, digital format. Data detected by the microbarograph array are recorded on magnetic tape at a central recording site, having been transmitted over telephone lines as frequency-modulated (FM) signals. The array selected for testing the technique is located at Huancayo, Peru, and is operated by the Instituto Geofisico del Peru. At the central recording site the signals are demodulated and recorded as amplitude-modulated(AM)signals. In order to analyze the extremely slow speed AM signal on a digital computer, the analog signal must be translated into a digital format for input to the computer. The analog-to-digital conversion (ADC) of such signals requires the development of a technique and the documentation of that technique is the purpose of this report. Author (TAB)

N70-34102*# TRW Systems Group, Redondo Beach, Calif.
LAUNCH ABORT DATA PROCESSING MANUAL
David C. Mc Dougall 10 Jul. 1970 117 p refs
(Contract NAS9-8166; Proj. Apollo)
(NASA-CR-108563; TRW-11176-H562-R0-00; TRW-70-FMT-837)
Avail: CFSTI CSCL 09B

The manual includes input definition for the PNCH08 Data Extraction Program and the Report Generator Program. Modifications to the TRW Plot (TRWPLT) Program are not included. The general method of obtaining publishable data through the use of the launch abort data processing software is also discussed. Author

N70-34104*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
ONBOARD PROCESSOR ADDRESSING AND PACKAGING EVALUATION Final Report
30 Apr. 1970 50 p
(Contract NAS5-10667)
(NASA-CR-109878) Avail: CFSTI CSCL 09B

Efforts to improve the programming capability of the onboard processing system (OBP) and to reduce the computer processing unit (CPU) control circuitry for improved packaging are considered. The project was divided into three main tasks, the first of which was to investigate techniques for improving the addressing capability of the OBP. Changes were made in the addressing system and the changes were incorporated into the CPU. The control circuitry was then evaluated so that it could be redesigned for better partitioning. Author

N70-34118# Air Force Cambridge Research Labs., Bedford, Mass.
THE AFCRL SYSTEM, 2
Arnold A. Barnes, Jr. *In its* Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 147–159 (See N70-34106 18-20)
Avail: CFSTI

Noise and data reduction problems encountered with the AFCRL system are discussed with emphasis on the data reduction problems. The system for checking the valid pulses of the radar set is described along with computer programs. The programs selects usable trails, reduces the data, and provides wind, height, and other data on punched cards. J.M.C.

N70-34172# Computer Co/p. of America, Cambridge, Mass.
CYCLOPS SYSTEM RESEARCH Final Report, 2 Jan. 1969–28 Feb. 1970
Thomas Marill, John Yates, and Elisabeth Turner 28 Apr. 1970 46 p refs
(Contract F19628-69-C-0162)
(AD-705598; AFCRL-70-0177) Avail: CFSTI CSCL 9/2

The Cyclops research project is aimed at developing computer-based systems that perform various processes on pictorial information, including enhancement and recognition. The work described in the report uses this pre-processing system as the basis for further research in the domain of recognition. Through this research, a process for matching fingerprints was developed. Through this research, a process for matching fingerprints was developed. With this process, fingerprints are pre-processed to extract certain minutiae, and these minutiae are then matched to determine if the fingerprints match. The present report describes the matching programs in detail. A sample run of the process for three fingerprints in shown. Author (TAB)

N70-34235# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A SPECIAL PURPOSE COMPUTER FOR SOLVING THE TRANSPORT PROBLEMS OF LINEAR PROGRAMMING
A. N. Klepikova 24 Mar. 1970 13 p refs Transl. into ENGLISH from Tr. Konf. Primeneniye Elektron. Vychislitelnykh Mashin V Stroit. Mekhan. (Kiev), 1968 p 457–462
(AD-705245; FTD-MT-24-41-70) Avail: CFSTI CSCL 9/2

A laboratory model of a specialized computer for solving m X n equals 10 X 15 transport problems is described. It has 600 transport-branch analog circuits, 80 power supplies for modeling production and consumption points, the distances between points are modeled by voltages of 0-10 V, the production volumes are modeled by currents of 0.2-30 mA, and the consumption points by currents of 0.2-5 mA. The error of a plan does not exceed 3 percent without refinement of the solution or 0.5,the solution or 0.5 percent with refinement. The maximum dimensions of problems m X n equals 10 x 60, 15 X 40, and 20 X 30, where m is the number of production points and n is the number of consumption points. TAB

N70-34286# Naval Postgraduate School, Monterey, Calif.
DES-1: AN INTERACTIVE CONTINUOUS SYSTEM SIMULATION LANGUAGE
Michael Alex Kalashian (M.S. Thesis) Jun. 1969 51 p refs
(AD-701677) Avail: CFSTI CSCL 9/2

There are strong tutorial advantages to Digital Computer Simulation of Control Systems problems. This is particularly true where such simulations do not require sophisticated programming techniques and where the user may directly interact with his-problem. The purpose of the study was to develop such a capability for the Naval Postgraduate Schools direct-access Computer System. The installation was to be accomplished using the DES-1 Simulation Language and an SDS 9300 Digital Computer. The DES-1 software requires a special DES-1 Console for optimum performance. Due to the lack of this Console, a reformulation of the language was necessary. This process involved simulating the Console and revising the language to operate with existing hardware. The language was re-written and the revised system has been installed as an operating system. Author (TAB)

N70-34321# California Univ., Los Angeles. Dept. of Computer Science.
COMPUTER NETWORK RESEARCH Semiannual Technical Report, 15 Aug. 1969–15 Feb. 1970

Leonard Kleinrock 15 Feb. 1970 77 p refs
(Contract DAHC15-69-C-0285; ARPA Order 1380)
(AD-705149) Avail: CFSTI CSCL 9/2

The report presents two papers on the ARPA computer network. The first dwells on analytic and simulation models suitable for computer network design. The second effort emphasized here is that of the HOST-HOST communication protocol in the ARPA network (HOST is a computer system which is a member of the ARPA network). TAB

N70-34352# Oak Ridge National Lab., Tenn.
MATHEMATICS DIVISION Annual Progress Report, Period Ending 31 Dec. 1969
C. W. Nestor, Jr., comp. Apr. 1970 134 p refs
(Contract W-7405-eng-26)
(ORNL-4514) Avail: CFSTI

An annual progress report is presented on mathematics and computer operations and mathematical statics at ORNL during the period ending Dec. 31, 1969. Progress in mathematical research, computer applications, systems programming, and computer services is outlined and discussed. NSA

N70-34355# Oak Ridge National Lab., Tenn. Health Physics Div.
CONVERSION OF THE NUCLEAR DATA 130A PULSE HEIGHT ANALYZER TO ASC 2 PAPER TAPE WITH MANUAL ENTRY FOR DATA IDENTIFICATION
P. T. Perdue and J. H. Thorngate May 1970 15 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2436) Avail: CFSTI

A conversion for the Nuclear Data Model 130 pulse-height analyzer to punched paper tape in the American Standard Code for Information Interchange is given. This conversion provides for manual entry of data-set identification to allow full use of the computer for data reduction. The separate unit described does not change any of the original data interfaces provided by the manufacturer of this pulse-height analyzer. Author (NSA)

N70-34359 National Lending Library for Science and Technology, Boston Spa (England).
COMPUTERS: NOTES FROM MOSCOW, NO. 205
27 Feb. 1970 8 p Transl. into ENGLISH from Russian newspapers
(NLL-Trans-205-(6167.650)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The operation of the Mir-2 electronic computer is described. It is capable of automatic transformation, integration and differentiation, and can solve equations in letter form. An automatic information retrieval system operating on a time-sharing basis is also discussed and the use of computers in controlling ship traffic in ports is explained. R.B.

N70-34373# Hawaii Univ., Honolulu.
SIMULATION OF INTERFERENCE OF PACKETS IN THE ALOHA TIME-SHARING SYSTEM Interim Scientific Report
W. H. Bortels Mar. 1970 30 p refs
(Contract F44620-69-C-0030; Proj. Themis)
(AD-705617; B70-2; AFOSR-70-1254TR; THEMIS-UH-70-2) Avail: CFSTI CSCL 9/2

The report describes a simulation of the random access communication method proposed in the University of Hawaii ALOHA time-sharing system. The simulation employs GPSS/360 to provide some insight into the upper limit of active users the ALOHA System may be able to support, the average number of retransmissions required as a function of active users and the number of times a given packet needs to be transmitted. Author (TAB)

N70-34374# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
THIRD HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES Final Report
N. Thomas Gaarder Apr. 1970 16 p Conf. held in Honolulu, Hawaii, 14–16 Jan. 1970
(Grant AFOSR-1883-70)
(AD-705616; AF-AFOSR-70-1121TR) Avail: CFSTI CSCL 5/11

The Third Hawaii International Conference on System Sciences was held from January 14 through January 16, 1970, at the Manoa Campus of the University of Hawaii. The document gives the Technical Program of the Conference which consisted of 358 papers in the general areas of computer sciences, circuit and system theory, information sciences, and system sciences. TAB

N70-34384*# Boeing Co., Washington, D.C. Space Div.
APOLLO LOGIC DIAGRAM ANALYSIS GUIDELINE
D. R. Pleas and R. S. Yoseph 17 Jun. 1968 120 p Revised
(Contract NASw-1650)
(NASA-CR-109901; D2-117018-1-Rev-A) Avail: CFSTI CSCL 09B

This document provides a general set of guidelines to standardize logic diagram (fault tree) methodology for system safety analysis in the Apollo program. These guidelines cover both the qualitative and quantitative aspects. Author

N70-34529*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
BUILT IN CHECKOUT (BIC)
[1969] 18 p
(NASA-TM-X-64344; MSC-EB-R-69-11) Avail: CFSTI CSCL 09B

In considering the two most likely missions, the space station/space base and the logistics vehicle or shuttle craft, two things become readily apparent. The space base will require an onboard data management system, as well as a ground data management system of some complexity, and the space shuttle will require some level of ground preparation with possibly an instrumentation philosophy similar to the X-15 experimental craft. Therefore, the primary effort to date has been the definition of the onboard data management system and the ground data management system. During the definition of these two systems, it became apparent that a common interface was lacking for the factory through complete mission type of checkout required. This paper is an attempt to define that interface and concurrently propose a new concept in checkout that substantially reduces the complexity of both systems. Author

N70-34655*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SCALE FACTORS FOR POWER SPECTRAL ANALYSIS ON THE TIME/DATA 100 COMPUTER
James T. Dollens and Winfield H. Farthing Jul. 1970 21 p refs
(NASA-TM-X-63992; X-645-70-290) Avail: CFSTI CSCL 09B

The Time/Data 100 is a small digital computer specialized in time-series analysis. Its algorithms include the Direct Fourier Transform, the Auto-Spectral Density and the Autocorrelation. The Power Spectral Averaging Algorithm applies the Direct Fourier Transform Algorithm to an input record. Then it squares and adds the real and imaginary components of the Direct Fourier Transform and accumulates each successive output record. An input record is a 1001 word block, where each word has 8 bits. An output record also consists of 1001 words, but has 18 bits per word. The computer has an oscilloscope and a plotter for analog output and tapes for digital output but they can only display 8 bits of the 18 bit output word. A scale factor was derived by analyzing the process of computing the power spectrum of an input data record. Each part of the scale factor is examined and its need justified. Examples to verify the above scale factor are included. Author

N70-34657# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STATE AND PRINCIPAL PROBLEMS OF THE

AUTOMATION OF PROCESS CONTROL ON THE BASIS OF COMPUTER ENGINEERING

S. F. Khrapchenko 11 Feb. 1970 16 p Transl. into ENGLISH from the book 'Perspektivy Primeneniya Vychislitelnoi Tekhniki Dlya Upravleniya v Promyshlennosti i Transporte' Moscow, Izd-Vo Energiya, 1968 p 33-44

(AD-705252; FTD-HT-23-628-69) Avail: CFSTI CSCL 13/8

Currently computers are becoming indispensable to efficient management and planning of production. At present a number of computerized billing, inventory, planning, production control and operative management systems is being introduced. New systems also are being developed. They include system for the planning, accounting and management of the basic production of a machine building enterprise, as well as standard automatic control systems for enterprises of the tractor industry. Not one of these systems, however, is sufficiently comprehensive. Although more than 170 Soviet organizations engage in R and D work on automatic production control systems, their activities are insufficiently coordinated thus resulting in dispersion of resources and duplication of research, and the rate at which new systems are being introduced is much too slow. TAB

N70-34675*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DATA HANDLING SYSTEM BASED ON SOURCE SIGNIFICANCE, STORAGE AVAILABILITY AND DATA RECEIVED FROM THE SOURCE Patent Application

Philip A. Jewell, inventor (to NASA) Filed 30 Oct. 1969 30 p

(Contract NAS7-100)

(NASA-Case-XNP-4182-2; US-Patent-Appl-SN-872664) Avail: CFSTI CSCL 09B

A data handling system is described in which data from a plurality of sources is received for temporary storage in a buffer and for subsequent supply to a utilization unit. The system includes means for controlling the storage of data in the buffer as a function of the available storage capacity of the buffer, the significance of the source providing the data, as compared with the significance of the other sources and the amount of data from the source which is already stored in the buffer. NASA

N70-34676# National Science Foundation, Washington, D.C.

[NONLINEAR 4-QUADRANT DRIVING POINT OR TRANSFER CHARACTERISTIC DEVICES]

L. L. Cleland 1970 22 p

(PB-190955) Avail: CFSTI CSCL 09B

The purpose of the invention is to demonstrate new devices which have transferred characteristics or driving point characteristics that lie in adjacent quadrants, i.e., in the first and second or third and fourth quadrants. The curves in the adjacent quadrants need not be symmetrical. The new devices are not restricted to any particular type of nonlinear characteristics; however, for convenience, a square law nonlinearity is discussed herein. It is shown that by using the new devices to generate square law characteristics, results as good or better than existing devices are obtained. Author (USGRDR)

N70-34681# C-E-I-R, Inc., Washington, D.C. Professional Services Div.

TOTAL INTEGRATED ENGINEERING SYSTEM (TIES). PROJECT DATA FILE, VOLUME 1 Final Report

Mar. 1970 130 p

(Contract FH-11-6957)

(PB-190954) Avail: CFSTI CSCL 13B

A series of utility computer programs, written in COBOL language, level F, were developed for the purpose of facilitating the structuring of an integrated series of engineering application programs. The routines provide a standardized method for the communication between application programs and a data file. They were developed specifically for the Total Integrated Engineering System. There are seven separate routines that make up the storage and retrieval utility. They provide for loading and unloading a master copy of the data file using magnetic tape for principal off-line storage, the allocation of special user files on tape or disk, and the reading and writing of user files on disk or tape. The final portion of the contract work included the evaluation and alteration of certain computer programs developed by the New York State Department of Transportation. USGRDR

N70-34698*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

CURRENT STEERING COMMUTATOR Patent Application

Russell K. Caplette, inventor (to NASA) Filed 15 Aug. 1969 19 p

(Contract NAS7-100)

(NASA-Case-NPO-10743; US-Patent-Appl-SN-850587) Avail: CFSTI CSCL 09B

A commutator for steering a controlled current successively through a plurality of loads is described. The commutator employs a two-phase magnetic core shift register comprised of a number of stages, each stage including a transmit core and a receive core. The plurality of loads equal in number the sum of the transmit and receive cores where unidirectional load currents are required. Where bidirectional load currents are required, a transmit core and a receive core are dedicated to each load. The cores are interconnected so as to shift a binary 1 (set state) from a stage transmit core to the receive core of the same stage during a first phase and then to the transmit core of the following stage during a second phase. Core drive pulses are alternately applied to all of the transmit and receive cores. NASA

N70-34743* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

BINARY MAGNETIC MEMORY DEVICE Patent

David H. Schaefer, inventor (to NASA) Issued 3 Aug. 1965 (Filed 29 Jun. 1961) 9 p Cl. 307-88

(NASA-Case-XGS-00174; US-Patent-3,198,955; US-Patent-Appl-SN-120803) Avail: US Patent Office CSCL 09B

A nondestructive readout and state changing circuit for a magnetic binary element is described. A magnetic winding is coupled to a magnetic core element capable of changing the remanent state of the magnetic element when pulsed by a predetermined signal. A readout signal with one polarity in the first portion and the opposite polarity in the second is applied to the state changing winding. The remanent state of the core is sensed in relation to the first portion of the signal and if the core is switched from one state to the other by the first portion, the second portion returns the core to the original state. Conversely, if the remanent state is not changed, the second portion of the signal is prevented from switching the state of the magnetic device. N.E.N.

N70-34747*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DIGITAL FILTER FOR REDUCING SAMPLING JITTER IN DIGITAL CONTROL SYSTEMS Patent Application

Tage O. Anderson (to NASA) and William J. Hurd, inventors (to NASA) Filed 23 Dec. 1969 21 p

(Contract NAS7-100)

(NASA-Case-NPO-11088; US-Patent-Appl-SN-887701) Avail: CFSTI CSCL 09B

A digital filter is described comprising two up-down counters A and B. Counter A, which is responsive to a sampled input signal quantized into three levels, +1, -1, and 0, is incremented in response to each +1 input, decremented in response to each -1 input, and remains unchanged in response to a 0 input. Counter B, which includes N stages, is incremented at each sampling time when A is positive, decremented when A is negative, and remains unchanged when A is zero. When B overflows in a positive direction, A is decremented by one while a negative overflow of B results in A being incremented by one. NASA

N70-34772# Joint Publications Research Service, Washington, D.C.

CYBERNETICS ON THE MARCH

N. Ilinskaya 17 Jul. 1970 10 p Transl. into ENGLISH from Sots. Industriya (Moscow), 7 Jun. 1970 p 4
(JPRS-50968) Avail: CFSTI

The use of cybernetic machines in science and production as well as mathematical programs for expanded utilization of digital computers is discussed. Computer calculations on plasma behavior in magnetic fields establish that under certain conditions, the temperature in the lower level of the plasma begins to rise by itself and, reaching a certain level, remains unchanged. This phenomenon is attributed to heat given off by electric current passing through resistance in the plasma conductor. Also described are computer calculations on geophysical data for oil bearing and water bearing state, diagnostic methods on automative systems, and imaging techniques. G.G.

N70-34778* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOGARITHMIC CONVERTER Patent
David H. Schaefer, inventor (to NASA) Issued 13 Jul. 1965 (filed 24 May 1962) 7 p Cl. 235-154
(NASA-Case-XLA-00471; US-Patent-3,194,951; US-Patent-Appl-SN-197553) Avail: US Patent Office CSCL 09B

A converter for compressing a nineteen or less digit binary input number into an eight digit binary output number approximately equal to the logarithm of the first number is described. The binary digits of the number equal to the number of digits in the input number minus four become the four most significant digits of the output number. The second, third, fourth, and fifth most significant digits of the input binary number become the four least significant digits of the output. The output indicates the value of the input to an accuracy of better than + or - 3%. The circuit and its operation are discussed. N.E.N.

N70-34787* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FULL BINARY ADDER Patent
David H. Schaefer, inventor (to NASA) Issued 20 Jul. 1965 (Filed 9 Jan. 1963) 4 p Cl. 235-176
(NASA-Case-XGS-00689; US-Patent-3,196,261; US-Patent-Appl-SN-250451) Avail: US Patent Office CSCL 09B

A circuit for a full binary adder which is stable over temperature and voltage fluctuations, does not require that complements of inputs be obtained, and is less complex in design than most adders is described. The circuit consists of four diodes, six transistors, and nine resistors, and the presences and absences of pulses represent the 0's and 1's. The circuit diagram and operation are discussed. N.E.N.

N70-34789# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
AN OPERATING SYSTEM FOR THE PDP-8/1
John S. Heidt, Charles L. Fricks, Wayne D. Smith, and Tse-Yu Wang 1970 73 p refs
(Grant NSF GN-655)
(PB-190816; GITIS-70-03) Avail: CFSTI CSCL 09B

An operating system for the PDP-8/1, specifically designed around hardware operating characteristics and providing interrupt handling facilities and task supervision capabilities, is discussed. Several alternative methods of implementation and possible future expansions are analyzed. The operation system's flowcharts and coding in SL/8, an intermediate language designed for the project, are included. Author (USGRDR)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-33444# Institute of Nuclear Research, Warsaw (Poland).
SLIDING PULSE GENERATOR FOR DIFFERENTIAL LINEARITY MEASUREMENTS
Z. Kulka 1969 19 p refs In POLISH; ENGLISH summary
(INR-1154) Avail: AEC Depository Libraries

Automatic testing of differential linearity is done by feeding a train of steadily higher pulses into pulse height analyzer at a constant rate. A sliding pulse generator for differential linearity measurements was built and its operation and performance are described. The results of the measurements are given. Author (NSA)

N70-33586# Post Office Engineering Dept., London (England). Research Dept.
A VARIABLE INDUCTOR FOR THE VIDEO-FREQUENCY RANGE, 1965 - 1967
J. M. Linke 18 Feb. 1969 35 p refs
(Rept-67) Avail: CFSTI

Inductors whose values are adjustable over a range 1:4 or more can be made from commercially-available ferrite pot-core parts. The principle of variable coupling between partial coils is employed. The windings are applied to the cylindrical wall sections of a pot-core; the two half-cores, separated by impregnated glass cloth, are rotated against each other around their common axis. The resulting inductance depends on the mode of connexion of the partial windings and varies approximately linearly with the angle of rotation. Q-factors approaching 400 can be obtained throughout the video-frequency range with modest demands on space. The inductance is sufficiently stable for most applications to passive networks, particularly equalizers and waveform correctors. Two practical examples utilizing 25 mm pot-cores are described, one for the upper video-frequency range, the other for the basic supergroup band. Some results obtained with a pot-core of 70 mm diameter are also given which indicate the usefulness of the arrangement down to audio frequencies. Author

N70-33613# Naval Postgraduate School, Monterey, Calif.
COMPUTER-AIDED NETWORK DESIGN BY OPTIMIZATION IN THE FREQUENCY DOMAIN
James Lau (M.S. Thesis) Dec. 1969 88 p refs
(AD-706008) Avail: CFSTI CSCL 9/5

The filter design problem is considered as an optimization problem. An iterative search technique is employed to adjust the variable network element values to approximate some desired network response, with a minimum of error. Explicit constraints are employed to ensure physical realizability. The design process uses a combination of a modified version of Calahans network analysis program with a direct search method of minimization developed by Hooke and Jeeves. The result is a procedure which uses the circuit designers experience and knowledge to set up the problem but relieves him of the tedious labor now performed by the high-speed digital computer. Author (TAB)

N70-33614# Naval Postgraduate School, Monterey, Calif.
COMPUTER-AIDED FILTER DESIGN
Alec Patton Taylor, Jr. (M.S. Thesis) Dec. 1969 44 p refs
(AD-706007) Avail: CFSTI CSCL 9/5

Several small-scale, special-purpose computer programs that were written to provide design data for a pulse-slimming filter over a wide range of parameter variations are contained herein. A large-scale computer program is also used to provide additional data. Some synthesis techniques are discussed, and some of the computer program outputs are directly applied in illustrating synthesis techniques for a specific pulse-slimming transfer functions. Author (TAB)

N70-33616# Osaka Univ. (Japan). Lab. of Nuclear Studies.
FABRICATIONS AND PROPERTIES OF SILICON DETECTORS

Inoue Fumio [1969] 21 p refs In JAPANESE; ENGLISH summary
(OU-LNS-69-5) Avail: AEC Depository Libraries

Surface barrier detectors, Si(Li) detectors, and Si(Li) surface barrier detectors for nuclear experiments were fabricated. The edges of surface barrier detectors were protected with amine-epoxy. The amine-free epoxy was slightly doped with iodine, and a 1/32-inch-wide ring of this resin was placed around the edge of the diode. By this treatment, detectors which are stable in a vacuum were obtained. The edges of Si(Li) detectors were covered with polyurethane to protect the detector from normal atmosphere. Characteristics of the Si(Li) detectors were stable in air over a year. Si(Li) surface barrier detectors of 1 to 3 mm effective thickness were fabricated by three methods including the cylindrical type, mesa type, and double-drift type. The method of double-drift type might be the best, especially for detectors of 3 to 5 mm thickness. The properties of these detectors are listed including resistivity, carrier lifetime reverse current, sensitive area, thickness, and resolution. Author (NSA)

N70-33637# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF ATMOSPHERIC CONTAMINATION ON THE PERFORMANCE OF CARBON BRUSHES ON COPPER SLIP RINGS
Philip Farr Grasser (M.S. Thesis) Oct. 1969 69 p refs
(AD-706025) Avail: CFSTI CSCL 9/1

The unsatisfactory performance of collector and commutator brushes in motor generators aboard nuclear submarines is introduced with the hypothesis that these difficulties are the result of atmospheric contamination. Following a survey of previously encountered contamination problems the experimental apparatus and procedures used to test this theory are described. Results of operation in eight simulated submarine environments are provided. Author (TAB)

N70-33657# Bhabha Atomic Research Centre, Bombay (India). Electronics Div.
BARC MODEL 228 DETECTOR BIAS SUPPLY
S. A. Cogate and S. G. Sule 1970 4 p
(BARC-452) Avail: AEC Depository Libraries

Circuit design and specifications for the BARC model 228 power supply which provides the bias voltage of either polarity for a semiconductor detector are described. NSA

N70-33731# California Univ., Berkeley. Electronics Research Lab.
ELECTROMAGNETIC WAVE-CHARGE INTERACTION IN CROSSED FIELDS Quarterly Progress Report, 16 Feb. 1969 – 15 Jan. 1970
K. A. Fox, S. Swierkowski, C. W. Turner, T. Van Duzer, and K. Weller Mar. 1970 54 p
(Contract DAAB07-67-C-0227)
(AD-705393; ECOM-0227-8; QPR-8) Avail: CFSTI CSCL 9/1

The purpose of the work is to investigate the interaction of electromagnetic waves and charge carriers in vacuum and solids. The construction of a crossed-field amplifier which incorporates the results of our noise studies has been completed. A flattened-helix circuit suspended on sapphire rods is used with a beam originating from a Kino short gun. Noise-figure measurements are in progress. Work on the crossed-field gun design method developed by Rao has been carried on to obtain designs for magnetically shielded guns. A design in which unavoidable beam crossovers are systematically reduced by periodic electrostatic focusing has been completed. An experimental evaluation of the crossed-field acoustic-wave amplifier has been conducted. A theoretical study of the electronic interaction with the acoustic wave under conditions not covered by collision-dominated dynamics has been performed and is to be published. Comprehensive measurements of amplification and lattice loss for the InSb acoustic shear wave amplifier have been performed. The work on the bulk acoustic wave InSb device has been terminated. A new project has been commenced with the aim of investigating the amplification of surface elastic waves in InSb. Theoretical work to establish the optimum crystallographic orientation and geometrical configuration for surface wave amplification is in progress. Author (TAB)

N70-33796# Environmental Science Services Administration, Boulder, Colo. Research Labs.
INDUCTION LOOP ANTENNAS FOR GEOMAGNETIC FIELD VARIATION MEASUREMENTS
Wallace H. Campbell Jun. 1969 65 p refs
(ESSA-ERL-123-ESL-6) Avail: SOD $0.65

This report describes the design considerations, construction techniques, and testing procedures followed in the preparation of large induction antennas for geomagnetic field measurements. The design was to provide a maximum amplitude, undistorted voltage response to magnetic flux density changes at frequencies below 5.0 c/s. The selected two-meter diameter antennas had between 8000 and 32,000 turns of fine copper wire with 0.127 mm diameter. Effects of some permutations in wire size and winding configuration are described. Details are given concerning the procedure for determining the antenna constants and calibrated response. Author

N70-33830 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
REPORT OF THE ELECTRONICS SECTION AND THE DIVISION OF DEVELOPMENT AND CENTRAL WORKSHOPS [BERICHT DES SEKTOR ELEKTRONIK UND ABTEILUNG ENTWICKLUNG UND ZENTRALWERKSTAETTENT]
In its Ann. Rept. 1969 May 1970 32 p refs In GERMAN
(See N70-33824 18-24)
(BEW 22) Copyright. Avail: Issuing Activity

The development of computer controlled experimental electronics continued and a new concept for memory display devices was obtained. Electronic equipment was developed for application in nuclear and radiological research with emphasis on control and regel systems in radiochemistry. Confidence data were obtained for semiconductor elements with planar technology, MOS technology, and solar cells in regard to their radiation resistance. Transl. by G.G.

N70-33883# ITT Electron Tube Div., Fort Wayne, Ind.
PATTERN THRESHOLD RECOGNITION DEVICE Quarterly Report, 1 Oct. – 31 Dec. 1969
Roger W. Hunter Fort Monmouth, N.J. ECOM Apr. 1970 23 p refs
(Contract DAAB07-69-C-0471)
(AD-705394; ECOM-0471-2; QR-2) Avail: CFSTI CSCL 9/1

The report describes the development effort on a pattern threshold recognition device. This tube consists of an electrostatic image-converter input, a storage-target which can be switched above its first cross-over potential in areas of target-information, a flood-gun to suppress the background information, and a read-gun on the reverse side of the target to provide and electrical output of the stored target-information. The tasks pursued toward development of this tube are: (a) An electrostatically focused and deflected read-gun with a collimating system was developed and tested. (b) Thin-film storage-targets have been fabricated successfully on a metal-mesh support. (c) A simulated target suitable for use in a direct-view storage tube was evaluated. It demonstrated the capability of switching the potential of heavily written areas above first cross-over while suppressing the lightly written areas. (d) a tube for target evaluation was designed and is being fabricated. (e) The design of the final tube configuration is complete, and fixtures are being made for fabrication and assembly of the tube parts. Author (TAB)

N70-33968# California Univ., Livermore. Lawrence Radiation Lab.
USE OF A LINEAR TAPERED SECTION IN MEASUREMENT OF IMPEDANCE AND ATTENUATION
W. E. Bostwick 24 Mar. 1970 23 p refs Presented at the 3d Ann. Conf. of the Precision Meas. Assoc., Washington, D.C., 17 – 19 Jun. 1970 Sponsored in part by AEC
(UCRL-72348; CONF-700602-1) Avail: CFSTI

Techniques for the use of 50-ohm test instruments for measurements of impedance and attenuation of devices were developed. The transition from 50 to 100 ohms was made with a linear tapered section. Use of this tapered section for attenuation measurements was straightforward and did not present any problems. Author

N70-34044# California Univ., Livermore. Lawrence Radiation Lab.
A LOGARITHMIC DETECTOR USING A PHOTOVOLTAIC DIODE
R. Kalibjian and J. G. Huebel 28 Jan. 1970 6 p refs Presented at the IEEE 2d Transducer Conf., Gaithersburg, Md., 4-6 May 1970 Submitted for publication
(PB-190179; UCRL-72084) Avail: CFSTI CSCL 18D

The use of photovoltaic diodes as logarithmic detectors was investigated. An analysis of the response of the diode shows that the dynamic range of the device decreases with increased loading. Experimental measurements on diffused GaAs diodes, which have threshold sensitivities in the 1-10 nW/sq cm. range, confirmed this analysis. Author (USGRDR)

N70-34049# Naval Research Lab., Washington, D.C.
PROCEEDINGS OF THE FOURTH SYMPOSIUM 1969 SPRING SUPERCONDUCTING SYMPOSIA
B. S. Deaver, Jr., S. Shapiro, W. Goree, and Z. J. J. Stekly Jun. 1969 61 p refs Conf. held at Washington, D.C.
(AD-705998; NRL-7023) Avail: CFSTI CSCL 9/1

Contents: Superconducting devices bagatelle or bonanza; Infrared detectors; Superconducting magnetometers; and Superconducting magnets. TAB

N70-34051# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRON-TUBE-TYPE OPERATIONAL AMPLIFIERS FOR AN ANALOG COMPUTER COMPLEX
D. E. Polonnikov et al 31 Mar. 1970 18 p refs Transl. into ENGLISH from the Russian
(AD-705848; FTD-MT-24-53-70) Avail: CFSTI CSCL 9/2

Described are three groups of amplifiers with gains ranging from 10,000 to 4,000,000. TAB

N70-34088# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNIFORM INTEGRATED CIRCUIT MODULUS
I. P. Egorov et al 30 Mar. 1970 15 p refs Transl. into ENGLISH from the Russian
(AD-705786; FTD-MT-24-34-70) Avail: CFSTI CSCL 9/5

A general purpose design for an integrated circuit module is described. Depending on the connection pattern with its substrate, the circuit can perform a variety of logic and circuit functions. The active and substrate portions are shown. The Roman numerals indicate inputs and arabic numerals the outputs. While p-n-p triodes are shown for simplicity, FETs or MOSFETs are proposed for actual use. The transistor matrix is composed of identical OR-NOT-AND elements, each of which realizes a given operation. Here x is an input variable, i.e., x equals 1 when feed voltage is applied; otherwise x equals 0. An example is given of the module connections required to obtain a one-bit adder with two inputs. The proposed matrix needs less commutations than would usual OR-NOT elements with three inputs, hence is theoretically more reliable in terms of fewer circuit connections. A module as a memory element is shown, where for example a positive input pulse at 1 or 1 will switch off and on; the reverse occurs with the signal applied to 0 or 0. The circuitry is developed on Si thin film, with SiO insulating layers where required. A ceramic substrate is used. Module leads are attached by thermal compression, and the entire assembly is hermetically sealed in a container. Author (TAB)

N70-34072# Boeing Co., Renton, Wash. Commercial Airplane Div.
EVALUATION AND TEST ON FLAT CONDUCTOR FEEDERS
J. P. Morris May 1970 59 p
(AD-705969; T6-5605) Avail: CFSTI CSCL 9/1

The test was conducted to determine if flat conductor cable (FCC) could meet the electrical requirements of a 3 phase AC power feeder system. Flat cable feeders were designed, procured and tested for capability of transmitting 90KVA power in an installation simulating routing for the 747 APU feeder system. Thermal and impedance characteristics tests were conducted on existing APU round wire feeders for comparison with the FCC under study. Author (TAB)

N70-34077*# Hartman-Huyck Systems Co., Huntington Station, N.Y.
HIGH CONTRACT CATHODE RAY TUBE Engineering Report
D. Bolum Washington NASA Jul. 1967 139 p refs
(Contract NAS12-605)
(NASA-CR-1597) Avail: CFSTI CSCL 09A

A high contrast cathode ray tube, employing an integrated faceplate filter, was developed. The improved non-reciprocal filter design consists of fabricating a 5-inch CRT faceplate, with integrated composite filters. Specifically, the faceplate developed is constructed of fluorescent glass with a very thin U.V. transmitting glass laminated or bonded to the interior and a spectrally matched passive color filter laminated to the exterior or viewing side. The non-reciprocal filter is constructed as an integrated part of the faceplate and, compared to a previously developed prototype, exhibits improved image resolution, more efficient heat transfer, and minimum specular and diffuse reflection while maintaining uniform contrast and readability under widely varying levels of ambient illumination. Efforts were concentrated on the problem of laminating the filter components into a single composite filter structure suitable for incorporation into a CRT as a high contrast faceplate. Author

N70-34091*# Aerojet-General Corp., El Monte, Calif. Space Div.
STUDY TO IMPROVE THE PERFORMANCE OF THE MICROWAVE RADIOMETER Final Report, Dec. 1968 – Dec. 1969
Mar. 1970 27 p ref
(Contract-NAS5-11633)
(NASA-CR-109879; Rept-1305-FR) Avail: CFSTI CSCL 09E

A prototype antenna system, including phase shifters, was designed and evaluated for the Nimbus program. Mechanical studies of a deployable system, including a mass model mockup, have provided sufficient design data for the fabrication of a 36x36-inch mechanically deployable radiometer system. A study was conducted to improve the mixer and IF amplifier on the microwave instrument for possible application on Nimbus E spacecraft. The study was centered on increasing the bandwidth and decreasing the noise figure for the mixer and amplifier. Author

N70-34092# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE APPLICATION OF CORRECTING CODES TO IMPROVE THE RELIABILITY OF COMBINATION LOGIC CIRCUITS
T. A. Frantsis 12 Mar. 1970 32 p refs Transl. into ENGLISH

from the Russian
(AD-705842; FTD-HT-23-152-70) Avail: CFSTI CSCL 9/5

The use of binary and generalized single-error correcting codes to synthesize decoders for redundant combinative logic circuits is examined. Given a logic circuit made up of OR-NOT elements that realizes the logic functions a logic circuit is synthesized with OR-NOT elements that will correct any single error using a Hamming code. As another example, a similar circuit is synthesized using a generalized code. A decoder for three two-output subcircuits is also synthesized using a generalized code. The use of error-correcting codes increases reliability only when the logic circuits are rather complex. TAB

N70-34138# California Univ., Los Angeles. School of Engineering and Applied Science.
DESIGN OF A LOCK-IN AMPLIFIER
Lawrence C. Caplan (M.S. Thesis) Mar. 1970 57 p refs Sponsored in part by Hughes Aircraft Co.
(Contract N00014-67-A-0111-0011)
(AD-705528; UCLA-70-13) Avail: CFSTI CSCL 9/5

The lock-in amplifier is an instrument capable of measuring a periodic signal under adverse signal to noise conditions, i.e., RMS noise at least 20dB larger than the signal. A synchronous detector followed by a narrowband filter is used to give a dc voltage output which is proportional to the input signal amplitude. The design stresses simplicity. By using relatively inexpensive integrated circuits preliminary testing indicated the performance could surpass existing standards. By using MOSFET chopper transistors in a series-shunt configuration the range of operating frequencies has been extended to 5 megahertz. The final unit is packaged in a 11 by 6 by 5 inch cabinet with a power supply. All operating conditions are met by using front panel controls and no external plug-in attachments are necessary. Author (TAB)

N70-34211# Syracuse Univ., N.Y. Dept. of Electrical Engineering.
THE COMPUTATION OF THE FREQUENCIES AND FIELDS OF A CAVITY RESONATOR CONTAINING A MAGNETOPLASMA DIELECTRIC Interim Scientific Report
Gordon Kent and Neil Sider Mar. 1970 46 p refs
(Grant AF-AFOSR-1266-67B)
(AD-705248; AFOSR-70-0852TR; TR-70-3) Avail: CFSTI CSCL 9/1

The computational procedures for obtaining the resonant frequencies, spatial parameters, and fields of a cavity resonator containing a cold, uniform, collisionless magnetoplasma dielectric are presented. The calculation of frequencies and spatial parameters involves the simultaneous solution of three equations. Two equations are rational in the three variables, and the third is transcendental in two of the variables. The transcendental functions have infinitely many real zeros and poles. An analysis is given to determine ranges of values of the spatial parameters and regions in the space of plasma parameters and frequency where solutions may exist. The method of solution starts with a trial value of frequency, the calculation of corresponding values of spatial parameters from two of the equations, and observation of the sign of the third function. A solution is determined by a change of sign of the third function. The transcendental functions are quotients of Bessel functions, and they are economically computed from continued fractions. The spatial paremeters enter into the field expressions as part of the arguments of Bessel functions. These functions, which have complex arguments, are computed from integral formulas. Author (TAB)

N70-34271# Pughe (E. W.) Development, Waltham, Mass.
ENHANCEMENT OF AN EXPERIMENTAL COLOR DISPLAY PROCESSOR Final Report, 1 Mar. 1968 – 31 Aug. 1969
Earle W. Pughe, Jr. 1 Mar. 1970 28 p
(Contract F19628-68-C-0171)
(AD-705596; AFCRL-70-0156) Avail: CFSTI CSCL 9/5

The work was primarily to improve the performance of an Experimental Display Processor developed under a previous contract. A capability was developed to display up to 1000 inches of line drawing at a 30 cycle refresh rate in a 9 x 9 inch area using any combination of 4096 colors and hues. The equipment includes a core memory, a list processor to take data from a computer and/or other input devices and make display lists in the core memory, a display processor which interprets the display lists, and a color CRT display which is controlled by the display processor. The unit also has a black and white display processor sharing the same core memory. The same or different data may be displayed by the two display processors. Author (TAB)

N70-34275# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MINIATURE DISPLAY UNIT
V. V. Bugayenko et al 9 Mar. 1970 9 p Transl. into ENGLISH from Mekhaniz. i Avtomatiz. Upr. (USSR), no. 2, 1968 p 39–41
(AD-705237; FTD-HT-23-120-70) Avail: CFSTI CSCL 9/3

A display unit designed with a magnetic-deflection-type miniature kinescope and transistors is described. The unit operates on the TV principle and is intended for desk-type digital computers. Its principal connection diagram is briefly explained. The display unit has these technical characteristics: anode voltage, 9 kv; line frequency, 1500 Hz; frame frequency, 50 Hz; sweep nonlinearity, 15 percent for lines, 5 percent for frames; temperature range, 5 plus 50C with a voltage variation within plus or minus 10 percent; amplitude of input sync pulses, 5 v; their duration, 4 mu sec; modulating-pulse duration, 2 mu sec; dimensions 120 x 230 x 130 mm. Author (TAB)

N70-34334*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CALIBRATION OF LINEAR INDUCTION MOTOR USING GSFC MARK 6 TORQUEMETER
Joseph C. Boyle and Robert W. Stewart May 1970 12 p
(NASA-TM-X-63983; X-325-70-229) Avail: CFSTI CSCL 09E

A linear induction motor was required to apply known torques to a spacecraft antenna drive system. The induction motor was calibrated and yielded torque as a function of antenna angular velocity and motor voltage. Author

N70-34335# Scientific-Atlanta, Inc., Atlanta, Ga.
INVESTIGATION OF PRECISION ANTENNA PATTERN RECORDING AND DISPLAY, PHASE 4 Final Technical Report
S. F. Hutchins Mar. 1970 80 p ref
(Contract F30602-68-C-0137)
(AD-705211; RADC-TR-69-465) Avail: CFSTI CSCL 14/3

The final report of work accomplished on precision antenna pattern recording and display techniques is presented. The equipment developed and reported herein is an experimental model of a digital recording subsystem to generate a high-accuracy on-line plot of relative signal amplitude vs. antenna angle while simultaneously recording the high resolution digital data on magnetic tape. Off-line operation includes the capability to search the magnetic tape and plot selected parts of the antenna pattern data thus recorded thereon. Author (TAB)

N70-34376*# Grumman Aerospace Corp., Bethpage, N.Y. Reliability and Maintainability Engineering.
MAINTAINABILITY DESIGN CRITERIA FOR PACKAGING OF SPACECRAFT REPLACEABLE ELECTRONIC EQUIPMENT Final Report
Jun. 1970 245 p refs
(Contract NAS8-24690)
(NASA-CR-109931) Avail: CFSTI CSCL 09E

An eight-month program was conducted to develop maintainability design criteria for the packaging of space electronic

equipment in the 1970–73 era. The purpose of the criteria is to assure rapid and easy removal and replacement during space mission operations. The criteria were defined for general application in extra-vehicular activity and intra-vehicular activity. A mock-up was designed and fabricated to demonstrate and verify the design criteria under dry simulated Zero-g test conditions. Author

N70-34377# Stanford Linear Accelerator Center, Calif.
AN IMPROVED TLD READER
G. K. Svensson, R. C. Mc Call, and G. L. Babcock Apr. 1970 21 p refs Presented at 2d Congr. of the Intern. Radiation Protect. Assoc., Brighton, Engl., 3–8 May 1970
(Contract AT(04-3)-515)
(SLAC-PUB-731; CONF-700505-1) Avail: CFSTI

Several improvements have been made in a TLD reader using the Conrad readout geometry. The major improvement is a heating system which utilizes a lead sulfide cell as a temperature sensor. The heating element is heated to a preselected temperature in 3 seconds and that temperature is maintained until readout is complete. The reader has a solid state electrometer and digital readout. Zero drift is virtually nonexistent. For an absorbed dose of < or = to 0.1 rad the readout temperature is not critical as long as it is above or equal to 240 C. For higher doses, the best precision is being achieved at a readout temperature between 280 C and 320 C. In high precision TLD work (e.g. 0.6% S.D.), the readout system contributes a significant but not dominant error. Teflon dosimeters are used for personnel dosimetry at SLAC. The readout cycle for them is 260 C for 15 seconds. This constant temperature cycle prevents the teflon discs from being damaged. Author (NSA)

N70-34432*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROJECT APOLLO EVALUATION OF ABLATION HEAT SHIELD MATERIAL SPECIMENS INCORPORATING ELECTRICAL CONNECTORS, PHASE 1
R. T. Gunderson 26 Nov. 1962 42 p refs Program Apollo Working Paper No. 1061
(NASA-TM-X-64299) Avail: CFSTI CSCL 09A

A preliminary study was made of the feasibility of passing an electrical conductor through the heat shield of the Apollo Command Module. The study included tests of seven specimens of phenolic-nylon material in the Langley Research Center 2500-KW Arc-Jet in the High Temperature Materials Laboratory. The three-inch diameter specimens contained patterns of holes of various diameters and depths. The data indicate that the holes had negligible effect on the integrity and ablation characteristics of the heat shield. The results indicate the feasibility of this design approach to provide electrical interface connections through ablative materials. Author

N70-34461# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
REVERSIBLE ELECTROMAGNETIC CONVERTERS WITH IMPROVED POWER INDICES
V. E. Tonkal *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 25–31 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Electromagnetic converter circuits using reversible magnetic amplifiers and with operating efficiencies of greater than 50% are considered. Emphasis is given to converters with recuperative energy in direct and alternating current circuits. Transl. by E.C.

N70-34477# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
CURRENT DISTRIBUTION OF PARALLEL-CONNECTED TRANSISTORS IN THE SATURATED STATE
Yu. I. Drabovich and V. S. Masloboyshchikov *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 140–144 In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Negative differential resistance of the transistors and the parameters of the signal source are taken into account when measuring current distribution. Experimental studies confirm calculated data and indicate that in the saturated state the current of individual transistors in a battery may exceed the values of current in the boundary state by 25 to 30%. The relative increase of current in the saturated state decreases when additional resistances are included in the circuits of each transistor. Additional resistances in the electrode circuits of transistors are an effective means of reducing nonuniformity of current in both the boundary and saturated states. Transl. by R.B.

N70-34478# Akademiya Nauk URSR, Kiev. Inst. Electrodinamiki.
DYNAMIC MODES OF SEMICONDUCTING DIODES IN dc POWER TRANSFORMERS
Yu. I. Drabovich and N. N. Yurchenko *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 145–150 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The parameters which best represent the frequency characteristics of power diodes operating on square-wave voltage and their dependence on operational modes are investigated. All the diodes display a certain inertia based on the phenomenon of storage and resorption of minority carriers in the base. The experiments show that temperature is the main criterion which determines the thermal mode of the rectifier, and that it depends on the magnitude of power losses in the diode. Transl. by R.B.

N70-34502* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RELAY BINARY CIRCUIT Patent
Roy E. Currie, Jr., inventor (to NASA) Issued 15 Jun. 1965 (Filed 24 May 1962) 6 p Cl. 317-140
(NASA-Case-XMF-00421; US-Patent-3,189,794; US-Patent-Appl-SN-197548) Avail: US Patent Office CSCL 09E

A counter-divider circuit is described for achieving greater accuracy and reliability in binary circuits, such as ring counters, decade counters, registers, and shirt registers. The circuit operates on very short input pulses. F.O.S.

N70-34556*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHASE SHIFT CIRCUIT APPARATUS Patent Application
Gordon J. Deboo, inventor (to NASA) Filed 21 Jul. 1970 12 p
(NASA-Case-ARC-10269-1; US-Patent-Appl-SN-56791) Avail: CFSTI CSCL 09E

A phase shifting circuit for selectively shifting the phase of an input signal from 0 deg to 180 deg, with the circuit maintaining the signal amplitude constant and independent of signal frequency, is described. The circuit includes resistive and capacitive elements, a voltage variable impedance element, operational amplifier means, and a phase detector coupled together in such a manner that a desired phase shift of anywhere between 0 deg and 180 deg can be selectively obtained in response to a simple adjustment of a circuit component. NASA

N70-34557*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONOSTABLE MULTIVIBRATOR Patent Application
Leonard L. Kleinberg, inventor (to NASA) Filed 28 May 1970 10 p
(NASA-Case-GSC-10082-1; US-Patent-Appl-SN-41430) Avail: CFSTI CSCL 09E

Circuitry for producing fixed duration output pulses with no power dissipation in the standby state is described. The monostable multivibrator includes a differential amplifier driving a transistor circuit, the output of which is fed back to the input of the differential amplifier to turn it off in a fixed period after the receipt of an input pulse. NASA

N70-34558*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AC POWER AMPLIFIER Patent Application
Arthur L. Newcomb, Jr. and Richard N. Young, inventors (to NASA) Filed 18 Jun. 1970 8 p
(NASA-Case-LAR-10218-1; US-Patent-Appl-SN-47441) Avail: CFSTI CSCL 09E

The characteristics of a high power, low distortion, alternating current power amplifier for laboratory and special applications are described. Principal advantages of the proposed amplifier are easier replacement of faulty transistors and reduction of short circuited outputs. NASA

N70-34596* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRICAL CONNECTOR FOR FLAT CABLES Patent
Wilhelm Angele and Hans G. Martineck, inventors (to NASA) Issued 15 Jun. 1965 (Filed 12 May 1961) 6 p Cl. 339-176
(NASA-Case-XMF-00324; US-Patent-3,189,864; US-Patent-Appl-SN-109789) Avail: US Patent Office CSCL 09A

A terminal insert connector for flat electric cables is described and illustrated. The connector has low current leakage between contacts. E.C.

N70-34628*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATED EQUIPOTENTIAL PLOTTER Patent Application
Earle R. Bunker, Jr., inventor (to NASA) Filed 9 Dec. 1969 17 p
(Contract NAS7-100)
(NASA-Case-NPO-11134; US-Patent-Appl-SN-883524) Avail: CFSTI CSCL 09E

Details are given on an apparatus for automatically drawing equipotential lines on a sheet of resistance paper, that has areas connected to different voltages of a voltage supply. An ordinary X-Y plotter is used, but the ink pen is insulated from its surroundings, and a wire is connected from the pen to the terminal where the slide wire is normally connected. The plotter is set for automatic X sweep and a preset voltage, equal to that of the equipotential line to be drawn, is connected to the Y input of the plotter. As a result, the difference between the voltage at the pen and the preset voltage drives the pen up or down, so that it always contacts points on the resistance paper which are of the voltage of the equipotential line to be drawn. NASA

N70-34651*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DIGITAL PULSE WIDTH SELECTION CIRCUIT Patent Application
Daniel F. Slowikowski, inventor (to NASA) Filed 7 Nov. 1969 9 p
(NASA-Case-XLA-07788; US-Patent-Appl-SN-874732) Avail: CFSTI CSCL 09E

A device for producing different pulse widths that are selected by a digital input is described. The device consists of a one-shot multivibrator including a timing circuit consisting of resistors and a capacitor. Each time a trigger pulse is applied to the multivibrator, a pulse whose width is proportional to the capacitance of the first capacitor is produced as its first output. The inverse of the first output is produced as a second output of the vibrator. The digital input selects one of the two or more possible pulse widths capable of being produced by the multivibrator. NASA

N70-34658# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF NUCLEAR RADIATION OF CADMIUM TELLURIDE PHOTOCELLS
B. M. Trakhbrot et al 12 Mar. 1970 11 p refs Transl. into ENGLISH from Publ. 'Radiatsionnaya Fizika Nemetallicheskikh Kristallov' Kiev, Izd-Vo Naukova Dumka, 1967 p 411–415
(AD-705248; FTD-HT-23-106-70) Avail: CFSTI CSCL 9/1

The parameters of CdTe photocells were studied as a function of time and changes in the diode and photocell characteristics were explained by the origin of acceptor levels during storage in air. The effect of nuclear radiation was determined on the CdTe photocell characteristics. Author (TAB)

N70-34692*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REFERENCE VOLTAGE SWITCHING UNIT Patent Application
Edgar S. Davis, inventor (to NASA) Filed 23 Mar. 1970 16 p
(Contract NAS7-100)
(NASA-Case-NPO-11253; US-Patent-Appl-SN-21906) Avail: CFSTI CSCL 09E

A reference voltage switching unit is described comprising a dual DC voltage power supply which provides +V DC and −V DC voltages across three of its output terminals, one of which is assumed to be at ground. The three terminals are connected to two unit output terminals through a switching unit which includes a voltage divider and three sets of SPDT contacts. The positions of the three sets of contacts are controlled as a function of the binary states of three stages of a three-stage ring counter. As the counter advances through its eight state cycle, the positions of the three sets of contacts vary so that the voltage across the unit output terminals follows a cyclically recirculating pattern. The unit provides discrete deflection offset voltages in star trackers, such as the Canopus star tracker. NASA

N70-34708*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRICAL CONNECTOR Patent Application
Charles D. Baker, inventor (to NASA) Filed 31 Mar. 1970 11 p
(Contract NAS7-100)
(NASA-Case-NPO-10694; US-Patent-Appl-SN-24224) Avail: CFSTI CSCL 09A

Details are presented on a soldered, electrically reliable, connector including a flexible, multistrand conductor and a terminal element which is susceptible of sterilization by heat. The improved connector has a soldered electrical connection mechanically reinforced with a swaged ferrule, so located as to render the connection accessible for visual inspection. It is isolated from mechanical strains incident to relative movement of the conductor and terminal element through an elastomer disposed within the barrel of the terminal element. NASA

N70-34783# California Univ., Livermore. Lawrence Radiation Lab.
PLANAR OSCILLOSCOPE
K. Aaland, E. Hsieh, and E. Westbrook Mar. 1970 15 p refs Presented at INTERMAG Conf., Washington, D.C., 21–24 Apr. 1970
(UCRL-72197) Avail: CFSTI

Magnetic thin films can be used in various arrangements on cards to provide the equivalent of an oscilloscope-camera combination for the recording of a single-shot transient signal. The basic phenomenon used is the uniaxial isotropy property of magnetic thin films. The waveform of the signal is traced out as the boundary wall between two magnetic domains in a single film, or as the dividing line between two groups of domains in plated wires or in arrays of small areas of film. A sweeping field creates hard-axis magnetization. At the trailing edge of the sweeping field, the algebraic sum of the signal present at that instant, and a static gradient field, determine a neutral point above and below which the magnetization relaxes to opposite easy-axis polarities. Advantages of the recording method include: possibility of planar packaging, signal times from dc to nanoseconds, electronic read-out and, from these latter two, the extension of memory oscilloscope technology to the nanosecond region. Author (NSA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-33612# Naval Postgraduate School, Monterey, Calif.
COMPUTER DESIGN OF CONTROL SYSTEMS USING ALGEBRAIC METHODS
Jesus E. D'Paola Lozada (M.S. Thesis) Dec. 1969 121 p refs
(AD-706009) Avail: CFSTI CSCL 12/1

Algebraic method techniques are applied to design linear control systems. Computer programs to accomplish the design procedure are presented. Several combinations of feedback and cascade compensated systems using different specifications are studied. Specifications considered include the system damping ratio, undamped natural frequency, bandwidth, steady state error coefficients and root sensitivity. The method is shown to be applicable to any transfer function and capable of working with any number of parameters. (Author) TAB

N70-33619# Joint Publications Research Service, Washington, D.C.
MEANS OF IMPROVING THE EFFICIENCY OF INFORMATION AND CONTROL SYSTEMS
B. I. Polikarpov *In its* Inform. Systems, USSR 11 Jun. 1970 p 1-11 (See N70-33618 18-34)
Avail: CFSTI

A discussion of the possibility of utilizing the basic concepts of cybernetics, the concepts of information, control and their interrelation, and also semantic information theory in developing the scientific methodology of improving information systems is presented. The solution of the problem formulated is complicated at this time by an insufficient amount of research in the field of the theory of scientific control methods and the general theory of information systems as an organic element of control systems. Author

N70-33664# Joint Publications Research Service, Washington, D.C.
SELECTIONS FROM THE FIELD OF CYBERNETICS, USSR
26 May 1970 12 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 191, no. 3, 1970 p 544-550
(JPRS-50596) Avail: CFSTI

CONTENTS:

1. NUMBER OF ERRORS CORRECTABLE BY THE REED-MULLER CODE R. Ye. Krichevskiy p 1-5 refs (See N70-33665 18-10)

2. THE USE OF DISCONTINUOUS GLIDE HYPERPLANES IN SYSTEMS WITH A VARIABLE STRUCTURE I. M. Makarov et al p 6-10 refs (See N70-33666 18-10)

N70-33665# Joint Publications Research Service, Washington, D.C.
NUMBER OF ERRORS CORRECTABLE BY THE REED-MULLER CODE
R. Ye. Krichevskiy *In its* Selections from the Field of Cybernetics, USSR 26 May 1970 p 1-5 refs (See N70-33664 18-10)
Avail: CFSTI

An investigation of the number of errors correctable by the Reed-Muller code is presented. Estimates made from Reed's algorithm make it possible to establish relationships between the lengths of an element. Coordinates are established to formulate the results of the set of n-dimensional binary vectors which transform under decoding. It is shown that the Reed procedure of decoding does not satisfy Shannon's fundamental theorem. J.M.C.

N70-33666# Joint Publications Research Service, Washington, D.C.
THE USE OF DISCONTINUOUS GLIDE HYPERPLANES IN SYSTEMS WITH A VARIABLE STRUCTURE
I. M. Makarov et al *In its* Selections from the Field of Cybernetics, USSR 26 May 1970 p 6-10 refs (See N70-33664 18-10)
Avail: CFSTI

A method for introducing information on the internal coordinates of the system into the control law is shown to be an effective way of avoiding multiple differentiation of the signal error. It is shown that the effect of change is less in the parameters of the object on the dynamics of the system with information on the internal coordinates in the control law. Differential equations describing the motion of the automatic control system with variable structure are given. J.M.C.

N70-33687# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
INHOMOGENEOUS AIR SPARK GAPS AT DIFFERING VOLTAGE LOAD [INHOMOGENE LUFTFUNKENSTRECKEN BEI VERSCHIEDENER SPANNUNGSBEANSPRUCHUNG]
Kurt Feser (Ph.D. Thesis) 1970 300 p refs In GERMAN
Avail: CFSTI

Inhomogeneous polarized electrodes were used to measure the effects of voltage form, gap width, opposing electrode, electrode form, internal resistance of voltage source, and predischarge currents on the flashover potential of direct voltage to breakdown voltage. Sparkover distance characteristics of various voltage stresses established the lowest stability for a positive rod-plate spark gap. Rod-rod spark gaps with definite anodic predischarge characteristics exhibited a linear response up to the largest investigated discharge gaps. The highest stability was found for a negative rod-plate spark gap. If different predischarges determined flashover voltage, a mixed distribution of flashover probability exists; a change in predischarge voltage resulted in a voltage switch. Electrode form, as well as environmental conditions (humidity), inner resistance of the voltage source, and the impulse shape of the votage are of decisive importance. A superimposition of dc and ac voltage established clearly that the predischarge prepared the final voltage breakdown in a negative rod-plate spark gap. Transl. by G.G.

N70-34032# Sandia Corp., Albuquerque, N.Mex.
PROCESSING PROTOTYPE PC BOARDS AT SANDIA LABORATORIES, ALBUQUERQUE
T. A. Allen [1970] 9 p Presented at the Inst. of Printed Circuits Meeting, Miami Beach, Fla., 15 Apr. 1970 Sponsored by AEC
(SC-DC-70-4807; Conf-700404--1) Avail: CFSTI

The different techniques used in producing printed circuit boards are discussed. The physical layout of the laboratory and the equipment used in the different processes are described. NSA

N70-34087# Boeing Co., Renton, Wash. Commercial Airplane Div.
HYBRID MICROCIRCUIT DESIGN AND PROCUREMENT GUIDE
J. W. Thornell, Warren A. Fahley, and W. L. Alexander May 1970 390 p refs
(AD-705974; D6-24576) Avail: CFSTI CSCL 9/5

The document has been prepared to serve as an interim guide to the system/circuit designers for the specification, selection design, procurement and evaluation of hybrid microcircuits for Avionics and Aerospace applications. Author (TAB)

N70-34458# Akademiya Nauk URSR, Kiev.
PROBLEMS ON THEORY AND ANALYSIS FOR CONVERTER DEVICE TECHNOLOGY
1968 252 p refs In RUSSIAN
Avail: CFSTI

Papers are presented on the theory and calculation of converter

systems (frequency converters, balancing units, current and voltage regulators and stabilizers, controlled rectifiers). Magnetic circuits and semiconductor devices are also considered. For individual titles see N70-34459 to N70-34494.

N70-34459# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
NOMINAL OUTPUT OF A FREQUENCY CONVERTER WITH MULTIPHASE MODULATION
A. N. Milyakh, R. P. Kartashov, and V. S. Fedly *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 9–15 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The nominal output of a multiphase modulated frequency converter was investigated for various types of converters: continuous frequency control from 0 to (n + 1) omega; multiplication and division at whole numbers, and six-time frequency multiplication with simultaneous conversion into a saw-toothed shape. Transl. by E.C.

N70-34460# Kiev Polytechnic (USSR).
COMPENSATING INVERTER CHARACTERISTICS
I. M. Chizhenko, Yu. F. Vydolob, and V. I. Borisenko *In* Akad. Nauk URSR Probl. on Theory and Analysis for Converter Device Technol. 1968 p 16–24 ref In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The relationship between the commutation angle and the control angle of deionization and the inversion current in a compensating inverter is assessed. It is shown that at angles of inversion exceeding the critical, the angle of commutation approaches but does not achieve a critical level with increases in current. Transl. by E.C.

N70-34462# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
STABILIZED CURRENT SOURCE OF STEPPED-UP FREQUENCIES
I. V. Volkov and S. I. Zakrevskij *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 32–39 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

A stabilized sinusoidal current supply source of stepped-up frequencies is described which uses semiconductors and inductance-capacitance converters. The frequency converters (50 into 700 hertz) contain output filters ensuring a constant load current despite large changes in resistance. The synthesis of the filter elements is discussed. Transl. by E.C.

N70-34463# Academy of Sciences of the Estonian SSR, Tallinn. Inst. of Thermophysics and Electrophysics.
RECTIFYING A DECLINE IN THE CHARACTERISTICS OF A MAGNETIC FREQUENCY DOUBLER BY USING INTERNAL FEEDBACK
V. V. Sarv and T. Yu. Syuvari *In* Akad. Nauk URSR Probl. on Theory and Analysis for Converter Device Technol. 1968 p 40–50 ref In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The reasons for the decline in the doubler external characteristics are analyzed as well as the feasibility of correcting the decline and other shortcomings by using internal feedback. It is assumed that the curves of the magnetic cores and voltage supply are at right angles, there are no losses in the doubler, and all the windings have the same amount of loops. Transl. by E.C.

N70-34464# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
MAGNETO-SEMICONDUCTOR FREQUENCY DIVIDER AND MULTIPLIER
K. A. Lipkovskiy and L. P. Melnichuk *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 51–57 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

A single-phase magneto-semiconductor frequency converter based on a key-transformer is evaluated. Output frequencies twice as high, twice as low, or equal to the power supply circuit frequency are possible. Methods for improving the shape of the curve of the converter output voltage are given. Transl. by E.C.

N70-34465# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
HARMONIC GENERATOR FOR REGULATING FREQUENCY CONVERTERS
L. P. Melnichuk and V. E. Tonkai *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 58–62 ref In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

A method of pulse-width modulation of square-topped pulses in accord with harmonic law is described. The method allows for control of harmonic oscillator frequencies over a wide range while maintaining the shape of the output voltage. Transl. by E.C.

N70-34466# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
MAGNETO-SEMICONDUCTOR PULSE-WIDTH MODULATOR
S. I. Zakreyskiy and V. N. Gubarevich *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 63–71 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Circuitry is examined for a pulse-width modulator consisting of a transformer self-saturating magnetic amplifier and two transistor switches. The magnetic amplifier contains two identical chokes. Two diodes separate the feed voltage choke working and control modes. Transl. by E.C.

N70-34467# Akademiya Nauk URSR, Kiev. Inst. of Elektrodinamiki.
ANALYSIS OF AN RC-PULSE SHAPER WITH STEPPED AMPLITUDE GAIN
O. V. Babak and B. V. Bolotov *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 72–78 In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

RC-pulse shapers are analyzed which convert dc voltage into stepped pulse trains. Simple and complex RC-pulse shaper circuits are treated. Transl. by E.C.

N70-34468# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
CONSTRUCTION OF PULSE SHAPER WITH STEPPED AMPLITUDE RISE AND PULSED INPUT FEED
O. V. Babak and B. V. Bolotov *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 79–85 In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Operating parameters and circuit characteristics for a RC-pulse shaper are reviewed. A procedure for increasing total pulse shaping time using condenser charge through fundamental voltage stabilizer tubes is discussed. Transl. by E.C.

N70-34469# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
SYMMETRIZATION OF ASYMMETRIC TRANSMISSION LINES
A. N. Milyakh and A. D. Muzychenko *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 86–92 ref In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Two methods are considered for eliminating asymmetric voltage at the output section of a transmission line under conditions of inequal conductivity of individual phases of an electrical power transmission circuit. Transl. by E.C.

N70-34470# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
BALANCING CIRCUITS WITH VOLTAGE DIVIDERS
A. K. Shidlovskiy and A. D. Muzychenko *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 93–100 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Circuits are examined in which the initial voltage phase on the balancing element is set up using autotransformer-type voltage dividers. Results allow reductions in the installed capacity of the balancing circuits, increases in power indices, and significantly expand the balancing capability. Transl. by E.C.

N70-34471# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
BALANCING TRANSFORMER CIRCUITS
A. K. Shidlovskiy and V. G. Kuznetsov *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 101–108 ref In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Transformer balancing units are evaluated in which the functions of transformation and voltage division are combined. The undesirable effects of unbalanced loads on generators and energy output units are eliminated by these units. Transl. by E.C.

N70-34472# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
CALCULATIONS ON A BALANCING UNIT WITH ELEMENTS COMBINED IN A STAR-SHAPED PATTERN
V. G. Kuznetsov and L. A. Zhurableva *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 109–113 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

A method is given for diagramming the parameters of a balancer with elements arranged in a star configuration. The diagram is applicable under all values of load power and in symmetrical circuits. Transl. by E.C.

N70-34473# Akademiya Nauk URSR, Kiev.
CALCULATIONS OF RECTIFIED CURRENT FORM AND PULSATION COEFFICIENTS IN ACTIVE-INDUCTIVE LOADS FOR VARIOUS RECTIFICATION CIRCUITS
I. V. Pentegov *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 114–118 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Mean and virtual values of rectified current are derived for various rectifier circuits. Resulting formulas in combination with others previously derived support calculations on many rectifier circuits now in operation. Transl. by E.C.

N70-34474# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
PROCEDURES FOR IMPROVING CURRENT CHARACTERISTICS IN ADJUSTABLE RECTIFIERS
B. E. Kubyshin and N. I. Timoshenko *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 119–125 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Methods are discussed for reducing the coefficient of pulsation and improving the coefficient of distortion in rectifier units with voltage controlled by magnetic amplifiers. Transl. by E.C.

N70-34475# Akademiya Nauk URSR, Kiev. Inst. of Elektrodinamiki.
TRANSIENT PROCESSES IN INDUCTIVE-CAPACITANCE CONVERTERS
I. V. Volkov, L. R. Slobodyan, and I. P. Lipkovskaya *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 126–133 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Transient characteristics were investigated for inductive-capacitance converters using symmetric T-shaped converter circuits. Equations are given for transient processes during switch-in to sinusoidal voltage and instantaneous change in constant circuit load. A technique is mentioned for determining the external characteristics of inductive-capacitance converters using oscillographs. Transl. by E.C.

N70-34476# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
MAGNETIC AMPLIFIER IN SWITCHING OPERATION
R. P. Kartashov and V. S. Fediy *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 134–139 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The relationships are examined between the fundamental parameters of an electromagnetic commutator and the characteristics of a magnetic amplifier and its control switch as well as the characteristics of the power source providing current to the control circuit. Transl. by E.C.

N70-34479# Akademiya Nauk URSR, Kiev.
THE PROBLEM OF CONSTRUCTION AND DESIGN OF RELAY SYSTEMS WITH A CONTROLLED ZONE OF INSENSITIVITY
M. S. Gusovskiy, E. M. Chekhem, and V. V. Shervashidze *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 151–155 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The possibility of constructing relay systems with a controlled zone of insensitivity and of obtaining stable relay systems with automatic control having a static error of zero is considered. A calculating expression is derived for controlling the zone of insensitivity of the relay element. Selecting the method of controlling the zone of insensitivity and constructing the circuit of the calculating device depend on the specific type of relay system. Transl. by R.B.

N70-34480# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
COMPARATIVE ANALYSIS OF THE PRINCIPLE CIRCUITS OF MAGNETIZED REGULATORS WITH CONSIDERATION OF THEIR TOPOLOGICAL PROPERTIES
G. A. Mikhalevich *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 156–161 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The functional possibilities and size capacity of regulators with two-contour, two-element configurations are analyzed for the specific mode of stabilizing the power voltage. The experimental results permit selection of optimum circuits and the graphical functions permit determination of the necessary parameter ratios of their various elements and fabrication of circuits from existing magnetic amplifiers, transformers, and autotransformers. Transl. by R.B.

N70-34481# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
COMPARATIVE ANALYSIS OF COMPENSATED AND UNCOMPENSATED MAGNETIC AMPLIFIERS
K. A. Lipkovskiy *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 162–166 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Compensated and ordinary magnetic amplifiers are compared with respect to their consumption of active materials. It is shown that such amplifiers are feasible when it is necessary to obtain a multiplicity factor exceeding a certain critical value. Other factors in selection of compensated amplifiers are the material and size of the cores, load output, and requirements for zero stability. Transl. by R.B.

N70-34482# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
FORMING THE EXTERNAL CHARACTERISTICS OF CONVERTERS WITH COMBINED CONTROL

O. M. Kostyuk and V. I. Reshetnyak *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 167–173 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Compensated converters with current and voltage feedback control are analyzed for the case where their external characteristics are formed according to a given law when the load resistance varies from zero to infinity. The study shows that sections of the external characteristics with negative feedback have acceptable stability and that the value of maximum negative feedback is determined by conditions of stability. Transl. by R.B.

N70-34483# Kiev Polytechnic (USSR).
SELECTING THE OPERATING MODES OF A TWO-BRIDGE INDEPENDENT INVERTER
I. M. Chizhenko and I. A. Kurilo *In* Akad. Nauk URSR Probl. on Theory and Analysis for Converter Device Technol. 1968 p 174–182 ref In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Problems are considered for rational selection of parameters characteristic of the operation of a two-bridge independent inverter as a function of the requirements governing the load characteristics of the converter. The output voltage is dependent on the load factor for the different control nodes and the constant load factor. Voltage stability is accomplished in the load range from nominal to 33%, and in the higher ranges may be accomplished by using a bank of capacitors with stepped control. Transl. by R.B.

N70-34484# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
MATHEMATICAL MODELING OF A SYSTEM OF AN INDUCTIVE-CAPACITANCE CONVERTER AND dc MOTOR
L. R. Slobodyan and Zh. A. Lezhanskaya *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 183–188 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The system is independently excited and its distinguishing feature is the possibility of regulating the motor speed by a dc armature in an alternating flux. The functional diagram is an integrated circuit with a given time constant and consists of series-connected elementary components described by given equations. The model of the system servomechanism is based on negative feedback control of the motor speed. Transl. by R.B.

N70-34487# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
APPLYING THE METHOD OF COMPLEX AMPLITUDES FOR CALCULATING THE HIGHER HARMONICS OF CURRENT AND VOLTAGE IN FERROMAGNETIC CIRCUITS
B. Ye. Kubyshin *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 204–214 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Concepts are considered which are related to an essentially nonlinear element and a combination of generators having harmonics with finite, conditionally nonlinear complex internal resistances. It is shown that by using the developed concepts a circuit with a single ferromagnetic element and an arbitrary number of linear elements can be designed by determining the required number of complex amplitudes of higher harmonics. The proposed model permits inclusion of phase relationships into the calculation and consideration of losses in the nonlinear element. Transl. by R.B.

N70-34490# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
OPERATIONAL ANALYSIS OF ELECTROMECHANICAL OSCILLATORS IN PULSE AMPLITUDE MODULATED SYSTEMS
V. N. Gubarevich *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 225–232 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The basic requirements inherent to power sources of electromechanical oscillators are the capacity to regulate the oscillating frequency, to maintain a given form of oscillations, and efficiency of the sources. It is shown that such requirements can be accomplished by using pulsed devices based on semiconductor switching elements. Formulas are derived for selecting the shape of the output oscillations according to the input signal and the parameters of the oscillator. Transl. by R.B.

N70-34491# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
A METHOD FOR PLOTTING ALL CURVES WITH A GIVEN NUMBER OF VERTICES AND EDGES
G. A. Mikhalevich *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 233–237 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

Plotting all curves with a given number of vertices and edges is accomplished according to their first incidence matrices, the search for which is conducted by using concepts of divisions found in combinatorial analysis. Specific examples of plotting the curves for various divisions are given for different electrical circuits. Transl. by R.B.

N70-34493# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
THE ASYMMETRY OF THREE-STEP ELECTRON MOTORS
V. A. Barabanov *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 243–248 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The dependence of the asymmetry of stator currents of a three-step electric motor on the orientation of rotor rotation in the stator system is considered. Analysis shows that the extent of asymmetry of currents is determined by the value of the angle between the axis of rotor rotation and the axis of the stator. The greater the angle, the greater asymmetry. The nature of the asymmetry depends on the angle which determines the direction in which the axis of rotor rotation is inclined with respect to the stator winding. Transl. by R.B.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-33580# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
THE 12 MeV MICROTRON USED AS INJECTOR OF THE FRASCATI ELECTRON-SYNCHROTRON
U. Bizzarri and A. Vignati 19 Dec. 1969 35 p refs *Its* Nota Interna No. 460
(LNF-69/78) Avail: CFSTI

The basic theory of the microtron is given and its design characteristics are described. The microtron produces a well collimated external beam of electrons of 60 ma peak current, 2 to 4 microsecond pulse duration, 20 pulses per second, at 12 MeV energy. R.B.

N70-33626# Naval Research Lab., Washington, D.C. Van de Graaff Branch.
NRL VAN DE GRAAFF OPERATION, 1 JULY–31 DECEMBER 1969

K. L. Dunning, ed. Apr. 1970 27 p refs
(AD-706015; NRL-MR-2124) Avail: CFSTI CSCL 20/7

The report is the fourth of a series of semiannual summaries on the use of the 5-MV Van de Graaff accelerator and associated instruments. The period 1 July 1969 to December 31, 1969 is covered. A brief statistical summary is presented, a few important developments concerning the maintenance and improvement of apparatus are discussed, and brief accounts of on-going and recently completed research projects are given. Author (TAB)

N70-33650# Institute of Nuclear Research, Warsaw (Poland).
THE CONSTRUCTION OF THE ION SOURCE POWER SUPPLY SYSTEM FOR THE VAN de GRAAFF ACCELERATOR "LECH" [KONSTRUKCJA UKLADU ZASILANIA ZRODLA JONOW W AKCELERATORZE ELEKTROSTATYCZNYM "LECH"]
Z. Kacprzak and L. Zemlo 1969 29 p refs In POLISH; ENGLISH summary
(INR-1134; Rept-1134/FI/PL) Avail: AEC Depository Libraries

The construction of the power supply system for the ion source, ion focusing and the belt discharging system is described. Also, the control system of the apparatus built inside the high potential terminal is described. Special attention was paid to the reliability of the apparatus because the whole system works at the high potential terminal of the accelerator under the gas pressure of 16 atm. at most. Author (NSA)

N70-33654# National Research Council of Canada, Ottawa (Ontario). Structures and Materials Lab.
NAE FLIGHT IMPACT SIMULATOR
J. W. Noonan and J. B. R. Heath *In its* The Div. of Mech. Eng. and The Natl. Aeron. Estab. 31 Dec. 1969 p 47-68 refs (See N70-33651 18-34)
Avail: CFSTI

The simulation of bird impact during flight is investigated to bird proof aircraft against bird hazards. The bird gun, bird types, firing sequence, instrumentation, photography, and performance are described. It is concluded that the flight impact simulator is a reliable impact loading tool operating through a velocity range from 250 to 700 ft/sec, using 4 and 8 lb birds as projectiles. F.O.S.

N70-33656# Institute of Nuclear Research, Warsaw, (Poland).
DEFLECTING MAGNET FOR ENERGY ANALYSIS OF THE 9.6 MeV PROTON LINEAR ACCELERATOR BEAM [ELEKTROMAGNES ANALIZUJACY WIAZKE AKCELERATORA LINIOWEGO PROTONOW]
Anna Mekler 1969 37 p refs In POLISH; ENGLISH summary
(INR-1133; Rept-1133/FLAP/E) Avail: AEC Depository Libraries

The symmetric electromagnet, having the capability of deflecting the 9.6 MeV proton beam by an angle + or - 60 deg is described. The magnet assures the simultaneous focusing in two perpendicular planes and allows an energy analysis with the accuracy of 25 keV. The magnet is excited from the three-phase full wave rectifier incorporating three silicon diodes and three transistors. The recitifier of nominal power of 7.5 kW has the current regulation range of 10 to 45 A that assures the excitation of a magnetic field in the range of 3000 to 9500 G. The current stabilization circuit consists of two loops of regulation and assures the stability of 0.0001. The efficiency of the stabilization system at maximum output is 89%. Author (NSA)

N70-33663# Joint Publications Research Service, Washington, D.C.
COMPLETE LABORATORIES FOR THE MEASUREMENT OF VIBRATION AND NOISE
O. Ye. Guzeyev et al *In its* Soviet Res. in Sanit. and Noise Meas. 11 Jun. 1970 p 11-13 (See N70-33661 18-34)
Avail: CFSTI

Three types of laboratories designed to measure noise and vibration in urban areas are briefly discussed; the apparatus used for these measurements is also described. Conclusions are drawn and formulated for lowering acoustic and vibrational levels. J.A.M.

N70-33677# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
RAPID ASSESSMENT OF SOIL STRENGTH AT AIRCRAFT LANDING SITES Instruction Report
G. N. Hammitt, II Apr. 1970 14 p refs
(AD-705572; S-70-1) Avail: CFSTI CSCL 1/5

The report presents a method of rapidly assessing the ability of an area to support aircraft operations. The method involves no special equipment or specially trained personnel, but is based on the interrelation of the response of ground surfaces of various strengths to vehicular and aircraft traffic. Data that allow the forecasting of the ability of an area to support aircraft traffic are tabulated herein. This ability is based on the rut depth occurring in a soil after one pass of a standard military vehicle. Author (TAB)

N70-33739*# Wyle Labs., Inc., El Segundo, Calif.
VIBRO-ACOUSTIC STUDIES OF BUILDING 49A FOR FUTURE NASA MSC MISSIONS
Jun. 1970 96 p refs
(Contract NAS9-7484)
(NASA-CR-108490; WR-70-6) Avail: CFSTI CSCL 14A

Environmental testing of spacecraft during the 1970's will involve expansion of existing facilities. Building 49A of the Manned Spacecraft Center will be used for some combined loads testing of large vehicles. Test requirements are projected into the next decade to predict dimensions and capability requirements to be imposed upon Building 49A. Expected pressure and thermal and dynamic loads are defined, and the requirements for simulation of these loads are discussed. Testing concepts and philosophies are used to lay a basic groundwork, particularly as applied to acoustic testing. Specific numbers are then derived to describe modifications to Building 49A and test methods to be used therein. These include comparisons of reverberant versus progressive wave sound fields. It is recommended that a steel or concrete liner be used to decrease room absorption. The height of the building is to be increased and both dimensions of the specimen access door will be increased to allow entrance of foreseeable vehicle components. The modified building will be designed primarily to test the vehicles of the 1970's in a reverberant acoustic field, with local positive and negative enhancement where required on the specimen. Author

N70-33751*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LANGLEY HOTSHOT TUNNEL OPERATIONS WITH HELIUM AT MACH NUMBERS IN EXCESS OF 30
Charles G. Miller, III Washington Jul. 1970 80 p refs
(NASA-TN-D-5901; L-6876) Avail: CFSTI CSCL 14B

The results of an exploratory study to generate extremely high Mach number helium flow in the Langley hotshot tunnel are presented for variations in reservoir pressure from 3000 to 28,000 lb/sq in. in reservoir temperature from 1500 to 11,000 R, and in geometric-area ratio from 3 × 10 to the third power to 8 × 10 to the fourth power. These variations resulted in a range of Mach numbers from 30 to 70. The effect of wide ranges of reservoir conditions and geometric-area ratios on decay of reservoir conditions, total tunnel run time, flow quality, various nozzle test-section flow parameters, nozzle boundary-layer characteristics, and nozzle axial gradients is discussed. Correlations of the nozzle boundary-layer thickness and displacement thickness are presented, and an existing empirical method for predicting nozzle boundary-layer displacement thickness in nitrogen was modified and extended to the Mach 30 to 60 region in helium. Semiempirical relations are presented for predicting free-stream and postnormal-shock conditions when only reservoir conditions and nozzle geometry are known. Author

N70-33770*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE SIMULATION OF IONOSPHERIC CONDITIONS FOR SPACE VEHICLES
Nobi H. Stone and Wilhelm K. Rehmann Washington Aug. 1970 29 p refs
(NASA-TN-D-5894) Avail: CFSTI CSCL 14B

A plasma wind tunnel, designed for the simulation of ionosperhic and solar wind conditions in an ultraclean environment using proper ion mass and energy and electron temperature, is described along with the system of diagnostic probes used for analysis. The operational characteristics of the system and the parameters of the drifting plasma indicate that the facility provides experimental capabilities in the areas of wake structure, sheath buildup, surface potential, drag forces, plasma-wave propagation, solar wind-magnetosphere interactions, and calibration of flight experiments. Author

N70-33910# FluiDyne Engineering Corp., Minneapolis, Minn.
STUDY OF AN UNCOOLED NOZZLE THROAT FOR A LARGE HYPERSONIC WIND TUNNEL Final Report
P. B. Hasselquist, K. W. Smith, and D. G. De Coursin May 1970 137 p refs
(Contract AF 40(600)-1186)
(AD-705577; AEDC-TR-70-92) Avail: CFSTI CSCL 14/2

A study was made of the feasibility of an uncooled throat for a large hypersonic wind tunnel facility using currently available materials. Maximum fullscale stagnation conditions would be 2000psi, 4400R, 1500 lb/sec air flow, and throat diameter 10.5-inches. The basic throat concept was that of a ceramic insulation layer, composed of small pieces, that would form a protective liner within a metal structure. High resistance to thermal spalling was the material characteristic of greatest importance. Tests were made of several zirconia materials and two zirconium diboride compositions by exposing them to hot air flow in a sonic throat at maximum conditions of 800 psi and 3550R. Behavior of the zirconia materials ranged from minor cracking to complete fragmentation. The zirconium-diborides did not crack and were oxidation resistant at these conditions. In addition, the thermal stress distribution was studied for the individual blocks that would form the throat insulation. For this purpose the three-dimensional stress distribution was calculated for mechanically unrestrained blocks having one-dimensional temperature distributions. Effects of temperature distribution, block size and block shape were determined. The computer program is included with the report. It was concluded that currently available materials are not satisfactory for a throat that would be used with no cooling. Author (TAB)

N70-33995*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VEHICLE MOBILITY TESTS, SOFT SOIL SLOPES
L. Kloc 25 Jun. 1970 58 p ref
(Contract NAS7-100)
(NASA-CR-109799; JPL-760-51) Avail: CFSTI CSCL 13F

Experimental results of a short series of exploratory tests are presented which investigate the character of the soft soil slope climbing problem. These experiments include: (1) laboratory tests of loaded plates on sloped sandy soils to evaluate the interaction of normal and shear forces. Limited results indicate the general influence of slope, depth of penetration, and surface roughness on the ratio of maximum shear to normal stress in sandy soils; and (2) vehicle slope climbing tests in soft soil. The general results indicate the inadequacy of current horizontal wheel tests to determine vehicle slope climbing performance and point out the dependence of drawbar pull versus slip curves on the soil slope. Author

N70-34048# Naval Research Lab., Washington, D.C. Nuclear Physics Div.
REPORT OF CYCLOTRON OPERATION, 1 JULY - 31 DECEMBER 1969
Mar. 1970 40 p refs
(AD-705484; NRL-MR-2103) Avail: CFSTI CSCL 20/7

The various research programs using positive ion beams of the NRL Sector-Focusing Cyclotron are briefly described, together with facility development and operations for the period 1 July - 31 December 1969. Author (TAB)

N70-34263# Naval Air Engineering Center, Philadelphia, Pa.
AIRFIELD ARRESTING GEAR EXPLORATORY DEVELOPMENT Final Report
L. Logan, L. Maier, and S. Puglisi 1969 83 p refs
(AD-701331; NAEC-ENG-7583) Avail: CFSTI CSCL 1/5

The report presents the results of investigations concerning the feasibility of various arresting gear system concepts for potential runway use at a maximum capacity of one hundred million foot pounds. In addition to existing and proposed complete systems, consideration is given to the integration of components from various systems to produce a new arrangement having desirable characteristics. A discussion of other factors related to airfield arresting systems is included. Author (TAB)

N70-34393*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EXTERNAL INSULATION AS A MEANS OF IMPROVING CRYOGENIC STORAGE SYSTEM THERMAL PERFORMANCE
Pat B. McLaughlan and Richard J. Boyer 5 Jul. 1967 68 p
(NASA-TM-X-64393; MSC-EP-R-67-15) Avail: CFSTI CSCL 13D

The primary objective of the test program was to evaluate the effectiveness of external insulation as a means of improving the thermal performance of a cryogenic storage system (CSS). Evaporation rate tests, using liquid nitrogen as the test fluid, were the basis for defining thermal performance. The CSS exterior was wrapped with laminar insulation and the thermal performance (heat leak) of the system was evaluated as a function of insulation thickness and environmental temperature. All thermal performance tests using external insulation were conducted in a vacuum environment of 10(-5) torr or better. Baseline thermal performance data were established prior to the application of the external insulation. A secondary objective of the program was to investigate the structural integrity of the insulation. The externally insulated CSS was subjected to rapid external decompressions, similar to those expected during launch operations. Author

N70-34535*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PERFORMANCE EVALUATION OF A LIQUID-SHROUDED CRYOGENIC STORAGE SYSTEM
Pat B. Mc Laughlan 29 Dec. 1967 31 p
(NASA-TM-X-64392; MSC-EP-R-67-41) Avail: CFSTI CSCL 13D

The primary objective of this test program was to evaluate a cryogenic liquid shroud as a means of thermal insulation for a primary cryogenic fluid contained in a pressure vessel. This information was required in order to establish feasibility of the concept in designing an alternate LM helium pressurization system. The thermal performance evaluation consisted of evaporation rate tests, nonvented standby tests, and minimum flowrate tests. For the first series of tests, liquid nitrogen was used as the shroud fluid and liquid oxygen as the primary stored cryogen. For the second series of tests, liquid hydrogen was used as the shroud fluid and helium as the primary cryogen. A design with a separate or isothermally mounted shroud, such as used in a standard liquid nitrogen shrouded helium dewar, essentially provides a controlled temperature environment for the pressure vessel contents by vaporization cooling of the shroud fluid. However, for the integral shroud design used, the pressure vessel wall is common to both the pressure vessel and shroud fluids and is not separated by a vacuum as in the isothermal shroud design. Author

N70-34618# Bureau of Radiological Health, Rockville, Md. Office of Information.
APPLICATION OF SMALL ACCELERATORS
May 1970 291 p refs Proc. of a Symp. held at New York, 8 – 9 Apr. 1969; sponsored by the New York Metropolitan Section of the Am. Nucl. Soc.
(PB-190994; BRH/CFS-70-2) Avail: CFSTI CSCL 20G

The symposium on Applicators of Small Accelerators was intended to provide present and prospective users of small accelerators with a concise review of current and future applications of such machines. The following topics were discussed: the use of small accelerators in teaching; a nuclear physics teaching course with a 500-keV Van de Graaff; the use of the small accelerator in university laboratories; nuclear physics research; trends in medical application of small accelerators; the importance of the low energy accelerator in the small undergraduate physics department; fast neutron physics and thermonuclear research; trends in medical application of small accelerators; and machine problems in generating neutrons for tumor therapy. Author (USGRDR)

N70-34786* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IMPACT SIMULATOR Patent
George W. Brooks, inventor (to NASA) Issued 27 Jul. 1965 (Filed 12 Jun. 1962) 9 p Cl. 73-432
(NASA-Case-XLA-00493; US-Patent-3,196,690; US-Patent-Appl-SN-202029) Avail: US Patent Office CSCL 14B

A test apparatus is described which simulates impact forces encountered by space vehicles or payloads during impact or landing under gravitational environments different from the earth's, and in particular the lunar gravitation. The simulator includes masses M1 and M2 suspended from opposite ends of a cable passed over two horizontal pulleys equipped with a brake or retention system. Mass M2 is adjustable in weight to compensate for frictional and aerodynamic drag and has counterpoise weights; mass M1 includes a housing for the impact apparatus, the vehicle to be tested, and an impact surface. By varying the mass M2, the acceleration of the mass system can be varied; with M2 greater than M1 the simulated g will be greater than earth's, and with M2 smaller the g will be less. For a lunar simulation, the mass M2 is adjusted to give it an upward and M1 a downward acceleration of 5/6 g. The payload inside M1 is released, falls at 1 g, and lands on the impact surface with an effective 1/6 g and bounces under the same conditions. N.E.N.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-33413# Technische Hogeschool, Eindhoven (Netherlands).
ON MIXING AND FLOW PATTERNS IN LIQUID-LIQUID DISPERSIONS
Joannes Baptista Wijffels (Ph.D. Thesis) 22 Jun. 1970 175 p refs
Avail: CFSTI

The behavior of dispersed systems of coarse particles were considered. In these dispersions particles move more or less freely through the continuous phase, and flow conditions are chaotic and of a stochastic nature. The hydrodynamic behaviour of two of the numerous applications of the dispersed system, the liquid fluidized bed and the liquid-liquid spray column are described. A general description is given of simple dispersions, treating the dispersion not only as the sum of its phases but also as a continuum. The basic conservation equations are discussed and diffusional phenomena and the propagation of density waves are described. An expression for the average dispersed phase drag coefficient is offered. Droplet size distributions are measured and from these results interparticle diffusion coefficients are calculated and compared with those computed from random walk experiments. Author

N70-33415# Politecnico di Torino (Italy). Ist. di Tecnologia Meccanica.
EXPERIMENTAL AND ANALYTICAL STUDY TO EVALUATE SMALL AIRFLOWS BY EMPLOYING CAPILLARIES
R. Ippolito, U. Kich, and M. Amoia 1970 15 p refs Presented at 4th Cranfield Fluidics Conf., Coventry, Engl., 17-20 Mar. 1970 Avail: CFSTI

A mathematical model is constructed to describe the behavior of capillaries. The model permits calculation of the air mass flow or the air standard volume flow in capillary tubes. Author

N70-33422# Politecnico di Torino (Italy). Ist. di Tecnologia Meccanica.
DESIGN AND INVESTIGATION ON A PROPORTIONAL VARIABLE-GAIN FLUID AMPLIFIER FOR INDUSTRIAL USE
R. Ippolito, M. Amoia, and U. Koch 1970 32 p refs Presented at 4th Cranfield Fluidics Conf., Coventry, Engl., 17-20 Mar. 1970 Avail: CFSTI

An industrial fluid amplifier was devised with variable gain by employing proportional deflection beam siluets. The classic close-loop network was designed and tested to obtain performances comparable to those of a traditional pneumatic process-regulator. Author

N70-33425# National Research Council of Canada, Ottawa (Ontario).
ANGULAR VALUE OF A SPOUTING CORE [ISSLEDOVANIE VELICHINY UGLA FONTANIRUYUSHCHEGO YADRA]
M. Z. Tsvik et al 1970 5 p refs Transl. into ENGLISH from Uzbeksk. Khim. Zh. (Uzbek SSR), v. 11, no. 4, 1967 p 64 – 65
(NRC-TT-1398) Avail: CFSTI

The initial angular value of a spouting core corresponding to the maximum drag of the bed and the minimum velocity of internal spouting was calculated. It was assumed that fluidization occurs when the drag of the bed equals the weight of material being fluidized. It was found that the angular value of the core increases slightly with an increase in cone angle and decreases with an increase of bed height. The effects of high and low beds and flow velocities are discussed. N.E.N.

N70-33516# National Research Council of Canada, Ottawa (Ontario).
SOME HYDRODYNAMIC FEATURES OF SPOUTING PULSATING FLUIDIZATION OF GRANULAR MATERIAL IN CONICAL APPARATUS [NEKOTORYE GIDRODINAMICHESKIE ZAKONOMERNOSTI FONTANIRUYUSHCHEGOPUL'SIRUYUSHCHEGO PROTSESSA PSEVDOOZHIZHENIYA ZERMISTYKH MATERIALOV V KONICHESKIKH APPARATAKH]
A. V. Golubkovich et al 1970 13 p refs Transl. into ENGLISH from Khim. Prom. (Leningrad), v. 43, no. 7, 1967 p 526 – 530
(NRC-TT-1395) Avail: CFSTI

Different models of conical apparatus were used for the investigations and the flow rate of the granular material was varied between 10 and 250 kg/hr. Pulsating conical apparatus with spouting beds are characterized by three critical spouting velocities, the first of which corresponds to the transition of the fixed bed to internal spouting, the second to the formation of the external spout, and the third to the start of the removal of solid particles from the apparatus. The pressure drops in spouting processes in continuously operating apparatus were investigated and found to

consist of several components which vary throughout the entire range of spouting velocities. The experimental results are expressed in terms of empirical equations. R.B.

N70-33599# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
ON THE STABILITY OF NORMAL SHOCK WAVES WITH VISCOSITY AND HEAT CONDUCTION Interim Scientific Report
Morris Morduchow and Alvin J. Paullay Jan. 1970 35 p refs
(Contract AF 49(638)-1623; Grant AF-AFOSR-1843-70)
(AD-705657; PIBAL 70-3; AFOSR-70-0447TR) Avail: CFSTI CSCL 20/4

The stability problem, for small arbitrary one-dimensional disturbances of a normal shock wave with viscosity and heat conduction in a thermodynamically perfect gas with a Prandtl Number of 3/4 is treated, and is formulated explicitly as an eigenvalue problem involving ordinary linear differential equations with polynomial coefficients in a fixed finite domain whose end points are singular points of the differential equations. It is shown by a simple general type of mathematical argument that one possible mode shape for the perturbations is a translation of the shock-structure, and that such a disturbance is neutrally stable. For the limiting case of a weak-shock structure, the equations developed are shown to reduce systematically to a perturbed form of Burgers equation. The weak shock structure is shown to be stable for any Prandtl Number and general equation of state, and a complete solution for the disturbance eigenvalues and eigenfunctions in this case is derived and discussed. Author (TAB)

N70-33623# Naval Postgraduate School, Monterey, Calif.
DROPLET SIZE MEASUREMENTS FOR LIQUID STREAMS INJECTED INTO A LOW-PRESSURE CHAMBER USING A LIGHT TRANSMISSION TECHNIQUE
Robert Orrin Corey (M.S. Thesis) Oct. 1969 46 p refs
(AD-706024) Avail: CFSTI CSCL 21/2

An apparatus was constructed for optical investigation of the sprays produced by liquid injection into a vacuum using various nozzle orifice sizes and driving pressures. A light transmission technique was employed to measure the mean diameter of the droplets in acetone sprays. Independent calculation of the densities of the sprays allowed the droplet sizes to be established by measuring the optical transmittance of a single spectrally pure wavelength of light through the sprays. A graph of droplet diameter, normalized for nozzle orifice diameter, vs. driving pressure was constructed. Mass and volume flow rates for the liquid injection system were calculated. Author (TAB)

N70-33633# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
DRAG MEASUREMENT IN A LOW DENSITY GAS STREAM
W. Stephenson and D. Whitfield May 1970 37 p ref
(Contract F40600-69-C-0001)
(AD-705576; AEDC-TR-70-25) Avail: CFSTI CSCL 20/4

Two methods of measuring the drag of bodies in a low density gas stream are described. The supersonic stream had a mean free path as great at 4 cm, and the drag forces were small. A drag balance was adapted from an electrical analytical balance to measure forces up to 70 dynes with less than 1-percent error. With this balance, the drag of spheres was measured for the Knudsen number range from 1.0 to 5. The freedrop trajectory method yielded drag coefficients in the range of Knudsen numbers from 2.5 to 30. These tests demonstrated the feasibility of making accurate drag measurements under the free-molecule conditions that can be generated by exhausting a gas into a cryogenically pumped vacuum chamber. Author (TAB)

N70-33690# Politecnico di Torino (Italy). Ist. Fisica Tecnica.
FLOW INSTABILITY IN A LOOP WITH NATURAL CIRCULATION [INSTABILITES DE DEBIT DANS UNE BOUCLE A CIRCULATION NATURELLE]
G. del Tin and C. Merlini Oct. 1968 32 p refs In FRENCH; ENGLISH summary Presented at the Euromech Meeting No. 7 on Mech. of Liquid Drops, Grenoble, France, 23-26 Apr. 1968 Submitted for publication
(PT-IN-60) Avail: CFSTI

Natural circulation stability was investigated using high pressure water loops. Flow oscillations were encountered when operating at high heat fluxes and at test section outlet temperatures close to, but below saturation. The flow perturbation was attributed to subcooled void formation in the heated duct. A pyrex glass tube loop was set up in order to visualize the system behavior just before and during oscillations. Water is the test fluid and the investigated pressure ranged from 1 to 3 atm absolute. Tests were carried out at constant power (from 1 to 5 kW). System conditions during steady state, threshold and oscillatory operations were filmed as needed on 100 fr/sec film. The results confirmed the conclusions of similar tests at high pressures i.e. 1) flow oscillations occur at outlet subcooled; 2) inlet subcoolings, corresponding to the instability thresholds, increase linearly with power; 3) oscillation periods decrease as power supply increases. Test conditions and parameters affecting oscillation onset and sustaining are discussed. Author

N70-33734# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
INHOMOGENEOUS TWO-STREAM TURBULENT MIXING USING THE TURBULENT KINETIC ENERGY EQUATION Final Technical Report
M. L. Laster (Ph.D. Thesis—Tennessee Univ.) May 1970 169 p refs Prepared in cooperation with ARO, Inc.
(Contract F40600-69-C-0001)
(AD-705578; AEDC-TR-70-134) Avail: CFSTI CSCL 20/4

A study was made on applying the turbulent kinetic energy approach to inhomogeneous two-stream turbulent mixing calculations and to calculations of a two-dimensional symmetric wake. Mixing calculations are made and compared with experimental data for coaxial hydrogen-air and air-air mixing flows. The turbulent kinetic energy equation is transformed into a transport equation for the turbulent shear stress by assuming that the turbulent shear stress is directly proportional to the turbulent kinetic energy. A flux model is assumed for the lateral diffusion of turbulent kinetic energy. The energy dissipation is modeled to a form similar to that derived for isotropic turbulence. Mass and energy transport are incorporated to the analysis by assuming the Prandtl and Lewis numbers to be unity. The resulting set of partial differential equations is hyperbolic and the method of characteristics are chosen for their solution. The theoretical method inherently incorporates history of the turbulent structure in the calculations which is physically more acceptable than turbulent structure models based on local flow properties. The results show that the turbulent kinetic energy approach is quite applicable to two-stream mixing problems, although the method requires further development before it is useful for routine engineering calculations. Calculations for a wake behind a flat plate are made and found to compare well with experimental data. The flux model for the diffusion of turbulent kinetic energy and the energy dissipation model were found to produce results which agree well with experimental data for both the mixing jet and the wake. Author (TAB)

N70-33738*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
EVALUATION OF A LIGHT-GAS GUN HYPERVELOCITY AUGMENTATION TECHNIQUE Final Report
R. N. Teng May 1970 55 p refs
(Contract NAS9-9312)
(NASA-CR-108494; MDC-G0596) Avail: CFSTI CSCL 20D

The interior ballistics of a constant base-pressure (CBP) gun are analyzed, relating the muzzle velocity to pertinent initial conditions in the gun. The specific chamber volume required for

the CBP launch cycle and the method of approximating the chamber volume are presented. Fifty-two runs were made with the light-gas gun to verify the theory and to identify the important parameters which may affect its performance. The departure of the CBP theory from the experimental results is identified as the friction between the piston and the high pressure section walls. Four types of collapsible pistons were developed to meet the requirements of the CBP launch cycle. The collapsible-piston designs were demonstrated to be particularly effective in damping out sharp pressure peaks during maximum performance runs. Author

N70-33754*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

EXPERIMENTAL STUDY OF THE RESPONSE OF A STATIC LIQUID-VAPOR INTERFACE AFTER A SUDDEN REDUCTION IN ACCELERATION

Leon J. Hastings 26 Jun. 1969 48 p refs

(NASA-TM-X-53841) Avail: CFSTI CSCL 20D

The dynamics associated with the formation of low-gravity equilibrium liquid-vapor interfaces after a sudden reduction in acceleration were experimentally investigated. A drop tower facility was used to obtain low-gravity durations of up to 4.3 seconds. Tests were conducted in 1/43 scale S-IVB liquid hydrogen and oxygen tanks using petroleum ether, a zero contact angle liquid, as the test fluid. Test data indicated that, except for very high Bond numbers and small fill levels in spherical or spheroidal containers, the time for a surface to attain complete equilibrium in containers about six inches or greater in diameter cannot be measured using drop tower testing. However, results were obtained that enabled estimates to be made of the time required for a surface to attain a state of quasi-equilibrium. Twenty-five tests were conducted using the cylindrical container and Bond numbers ranging from 24 to 94. The results indicated that the time required for the surface to attain quasi-equilibrium in a six-inch diameter cylinder is about 30 seconds and 3.25 seconds at Bond numbers of 24 and 94, respectively. The surface formation characteristics observed in the model oxygen tank during four tests are presented. Author

N70-33772*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CALCULATIONS OF THE FLOW OF NATURAL GAS THROUGH CRITICAL FLOW NOZZLES

Robert C. Johnson 21 Nov. 1969 21 p refs Presented at the Ann. Meeting of the ASME, Los Angeles, 16-21 Nov. 1969

(NASA-TM-X-52646) Avail: CFSTI CSCL 20D

The mass flow rate of methane and nineteen natural gas mixtures through critical flow nozzles was calculated. The calculation assumes the flow to be one-dimensional and isentropic. The pressure range is 0 to 1000 pounds per square inch and the temperature range is from 450 to 700 degrees Rankine. From a study of the results, a simple empirical method for making this mass flow rate calculation is proposed. This method would apply to natural gas mixtures whose composition is known and whose components have no more than four carbon atoms. Author

N70-33784*# Techtran Corp., Glen Burnie, Md.

ONE METHOD FOR ESTABLISHING BOUNDARY CONDITIONS FOR PROBLEMS OF FLOW OF A VISCOUS FLUID [OB ODNOM SPOSOBE POSTANOVKI GRANICHNYKH USLOVIY DLYA ZADACH TECHENIYA VYAZKOY ZHIDKOSTI]

T. S. Varzhanskaya Washington NASA Jul. 1970 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 3, 1969 p 142 - 144

(Contract NASw-2037)

(NASA-TT-F-13027) Avail: CFSTI CSCL 20D

Boundary conditions are proposed for the case of flow of a viscous incompressible liquid. Their use is illustrated in a problem involving flow around the leading edge of a semi-infinite sheet. Author

N70-33788# Boeing Scientific Research Labs., Seattle, Wash.

TURBULENCE MEASUREMENTS IN STABLY STRATIFIED FLUIDS

Yih-Ho Pao Feb. 1970 50 p refs Presented at the Symp. on Turbulence Meas. in Liquids, Rolla, Mo., 8-9 Sep. 1969

(AD-704984; DT-82-0959) Avail: CFSTI CSCL 20/4

A towing tank system was used to study the structure of turbulence in stably stratified fluids. Turbulence is generated by moving an obstacle (a grid or a cylinder) in a tank of stratified salt water. Recent improved shadowgraph pictures of these laboratory generated stratified flows are shown in the paper. They give further support to Paos observation that (1) internal waves and turbulence coexist in turbulent stratified flows, with internal waves at the large scales and turbulence at the small scales; (2) turbulence decays much more rapidly than internal waves; and (3) the turbulent-nonturbulent interfaces are not necessarily sharp, and the transition region may consist of mostly internal waves. Diagnostic methods to distinguish internal waves from turbulence with two probe measurements are proposed. Author (TAB)

N70-33794# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

SIMILAR SOLUTIONS OF THE ATTACHED AND SEPARATED COMPRESSIBLE LAMINAR BOUNDARY LAYER WITH HEAT TRANSFER AND PRESSURE GRADIENT Final Report

James W. Christian, Wilbur L. Hankey, and James S. Petty Feb. 1970 117 p refs

(AD-705581; ARL-70-0023) Avail: CFSTI CSCL 20/4

The development of governing equations and tabulation of similar solutions to the two-dimensional, laminar, compressible boundary layer with heat transfer are presented. Similar velocity and temperature profiles and global quantities such as displacement thickness, momentum thickness, form factor, etc., are presented for 116 pressure gradient-heat transfer combinations. Surface temperatures for these cases range from absolute zero (S(0) = -1) to twice the free stream stagnation temperature (S(0) = + 1), while the streamwise pressure gradient varies from values corresponding to maximum reversed flow (beta = -0.36) to those of extremely accelerated flows (beta = 20). Results are presented at regular intervals of the parameters S(0) and beta, allowing for straight-forward comparisons between cases. Five decimal place accuracy is maintained for all results. Author (TAB)

N70-33871# Dartmouth Coll., Hanover, N.H. Tayer School of Engineering.

TWO-PHASE, GAS-LIQUID NOZZLE FLOW

Daniel A. Sullivan and Graham B. Wallis Nov. 1969 194 p refs

(Grant NSF GK-1841)

(PB-189696) Avail: CFSTI CSCL 20D

An experimental investigation of two-phase, two-component, air-water critical and subcritical nozzle flows with an annular/stratified flow pattern is described. The nozzle exhausted to atmospheric pressure from stagnation pressures of 16 to 55 psia. The quality range was from 2% to 35% with a theoretical gas void fraction range of .4 to 1. A feature of the study was the air-water injection system which was designed to minimize the entrainment of liquid into the gas phase and to minimize interfacial disturbances. A theoretical two-phase, two-component, separated flow model is developed which characterizes annular and stratified flows. An extension of the separated model incorporates homogeneous flow theory to describe the thick liquid film flows along with a gas phase 'core' flow with entrainment. The hybrid model reduces to the separated flow model for the case of no entrainment and to the homogeneous flow model for total entrainment. The effects of entrainment and interfacial waves are discussed. The theoretical model is designed to describe the the physical flow situation. In this way the potential for further sophistication by incorporating additional features of the real flow

situation is enhanced. A simple empirical 'blockage factor' correlation is derived which predicts most of the data within 10%. Author (USGRDR)

N70-33908# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
AN EXPERIMENTAL INVESTIGATION OF TURBULENT STRATIFIED SHEARING FLOW
Michael J. Moore and Robert R. Long Dec. 1969 59 p refs
/ts Ser. K
(Grant ESSA-E22-36-69/G/)
(PB-189415; TR-1) Avail: CFSTI CSCL 20D

Some experiments are described in which steady-state shearing flows are developed in stratified brine solutions contained in a cyclically continuous tank of rectangular cross-section. Measurements are made of the velocity and density profiles which result when two homogeneous layers of different densities and initially separated by a diffusion-thickened interior layer are moved with equal and opposite speeds. It is found that the mean velocity is linear while the mean density profile has definite curvature (on either side of an inflection point) over a layer thickness such that a Richardson number, defined by averaging gradients over this layer, has a value of approximately one. Other experiments, made in the same apparatus, describe the entrainment of an initially quiescent layer of fluid with a linear density gradient by a turbulent homogeneous layer. Author (USGRDR)

N70-33927# Norges Tekniske Hoegskole, Trondheim. Inst. for Mekanikk.
EXPLORATORY EXPERIMENTS IN WATER ON STREAM-WISE VORTICES AND CROSSHATCHING OF THE SURFACE OF REENTRY BODIES Final Report
Leif N. Persen Wright-Patterson AFB, Ohio ARL Sep. 1969 81 p refs
(Contract F33615-67-C-1758)
(AD-705631; ARL-69-D160) Avail: CFSTI CSCL 16/3

A detailed description is given of the experimental results obtained on the stream-wise vortices using a water jet as an experimental device. Information on the vortices was obtained through a study of the stream-wise striations left in the coat on the models used by the outside flow. Striation counts were performed and the wavenumber thus obtained is related to the flow parameters. The contention that the stream-wise vortices appear as a result of the outside curved flow becoming unstable is strongly supported. Author (TAB)

N70-33937# Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
OCEANIC MIXING
Akira Okubo Jan. 1970 152 p refs
(Contracts AT(30-1)-3109; Nonr-4010(11))
(NYO-3109-49; TR-62) Avail: CFSTI

The present knowledge of oceanic mixing is summarized. Two processes, advection and diffusion, which contribute substantially to oceanic mixing and their interaction are recognized in the mechanism of mixing. Environmental features of the sea in relation to advective and diffusive processes are also described. Author

N70-33957# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
AN AXISYMMETRIC NEAR WAKE ANALYSIS USING ROTATIONAL CHARACTERISTICS
Mauro Pierucci Feb. 1970 87 p refs
(Contracts Nonr-839(38); DAHC04-69-C-0077; ARPA Order 529; ARPA Order 1442)
(AD-705515; PIBAL-70-7) Avail: CFSTI CSCL 20/4

The near wake of a cone in a hypersonic stream is analyzed by simultaneously solving the inviscid region and the viscous shear layer. The inviscid region is solved by the use of rotational axisymmetric characteristics. It is assumed that viscosity and heat transfer play an important role only within a region bounded by streamlines which at the trailing edge of the cone are for the most part in the subsonic portion of the boundary layer. This region, termed the shear layer, lies between the dividing streamline (or centerline) and the basic streamline. The solution to the inviscid region is obtained by specifying conditions along the characteristic line originating at the shoulder of the cone, and by specifying the pressure distribution along a free surface (basic streamline) taken to be the streamline which at the shoulder of the cone separates the supersonic from the transonic and subsonic portions of the boundary layer. The pressure distribution along the basic streamline is iterated until the mass flow, momentum, and energy in the shear layer are consistent with the location of the dividing streamline and with the initial conditions at the edge of the cone. Profiles for pitot pressure, static pressure and stagnation enthalpy are presented and compared with experiments at different downstream locations. The shape and strength of both the lip and recompression shock are also shown. Both sets of results are seen to be in very good agreement with the experimental results available. Author (TAB)

N70-33968# Avco Corp., Wilmington, Mass. Government Products Group.
EXPERIMENTS ON WATER DROP BREAKUP BEHIND MACH 3 TO 12 SHOCKS
Wm. Reinecke and W. L. Mc Kay Jun. 1969 62 p refs
Prepared for Sandia Corp.
(SC-CR-70-6063) Avail: CFSTI

Shadowgraphs of the disintegration of water drops in the region behind air shock waves have been obtained at shock Mach numbers from 3 to 12. Drop diameters ranged from 0.5 to 2.5 mm and initial pressures from 760 to 90 torr. Over the entire test range the drop trajectories are correlated by a simple application of Newton's second law. At shock speeds from Mach 3 to Mach 6 the drops are progressively stripped by the shearing of the surrounding air and the dimensionless time to breakup is about 6. Above Mach 6, where the drops experience accelerations in excess of 1 million g, an apparent surface instability results in the destruction of the drop before breakup is accomplished by the stripping action. As a result, the dimensionless time to breakup decreases to about 4 at Mach numbers above 10. These results are combined with other data available in the literature, and a general plot of time to breakup versus dynamic pressure behind the shock is presented. Author (NSA)

N70-33970# Naval Research Lab., Washington, D.C. Mathematics Research Center.
THE PIECEWISE ERGODIC PROBLEM FOR GAS SYSTEMS Final Report
Howard E. Conner 25 Feb. 1970 8 p refs Its Math. Res. Center Rept. No. 70-3
(AD-706002; NRL-7043) Avail: CFSTI CSCL 20/4

A brief outline is presented of the piecewise ergodic problem of organizing and ordering the various relaxation processes of a gas system. Author (TAB)

N70-34060# Naval Postgraduate School, Monterey, Calif.
SURFACE WAKE OF A CIRCULAR CYLINDER IN DILUTE AQUEOUS SOLUTIONS OF POLYETHYLENE OXIDE
Michael Henry Fletcher (M.S. Thesis) Jun. 1969 60 p refs
(AD-705105) Avail: CFSTI CSCL 20/4

The wake formed by surface-piercing circular cylinders towed through 0, 100, and 200 parts per million (by weight) aqueous solutions of Poly(ethylene oxide), Polyox WSR-301, was examined photographically. Cylinder diameters ranged from 1/4 in. to 2 in. Froude numbers from 0.8 to 10. Measurements of spray height and ventilation pocket depth were made. No significant alteration of pocket depth with polymer concentration was observed; however, the spray height was reduced by increasing the Polyox

concentration. Qualitative differences between the wakes of cylinders in Polyox solutions and those in water were (1) a serrated separation line characterized the ventilation pocket of the polymer solutions as opposed to the straight separation line of water, (2) the striated appearance of the pocket walls in Polyox instead of the clear, smooth walls in water, (3) the coherence displayed by the spray in Polyox instead of the random character of the spray in water, and (4) the larger and more irregularly shaped bubbles in Polyox as opposed to those in water. Author (TAB)

N70-34067*# Norton Research Corp., Cambridge, Mass.
DEVELOPMENT OF A GAS SAMPLING SYSTEM
J. E. Hueser and F. J. Brock Washington NASA Jul. 1970 129 p refs
(Contract NAS1-5347-15)
(NASA-CR-1603) Avail: CFSTI CSCL 14B

The results of a theoretical analysis and a computed performance evaluation of a gas sampling system for use abroad a high speed entrycraft are presented. The mathematical analysis presented, establishes the fraction of the flux, incident on the entrance of the gas inlet system, which is transmitted without suffering either a gas-gas or gas-wall collision, and the ratio of the unscattered to scattered exit flux per unit solid angle (signal-to-noise ratio). The scattered gas density distribution inside the gas inlet tubes, the temperature of the gas inlet as a result of the high enthalpy incident flux, and the functional dependence of each of these parameters on the atmospheric density, entrycraft velocity, and inlet tube dimensions are also included. Data are presented for these parameters to establish the limit of operation (highest atmospheric density) of the sampling system for an analysis of the Martian atmosphere. Author

N70-34095# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
STEADY AND PULSATING TWO-DIMENSIONAL TURBULENT, WALL JETS IN A UNIFORM STREAM Final Report
August Verhoff Mar. 1970 374 p refs
(Grant Nonr-1858(14))
(AD-705235; Rept-723) Avail: CFSTI CSCL 20/4

For the case of the steady, plane turbulent wall jet, the growth of the jet and decay of maximum velocity are predicted based upon the assumption that the shear stress distribution as well as the velocity distribution across the jet remain similar over the useful range of downstream positions. A suggested form for the velocity distribution is compared with the experimental results of this investigation and with the results of several previous investigators. The approach used in the analysis of the plane turbulent wall jet is then extended to the more general case of a steady turbulent wall jet beneath a secondary uniform stream. The experimental results of this investigation and other previous investigations are compared with the velocity profiles as predicted by the analysis. The case of a pulsating wall jet flow field was also analyzed. A simplified theoretical model is presented based upon the experimentally observed discrete vortex pattern produced by the unsteady jet. The analysis for both zero and nonzero secondary flow velocity relies to a large extent on many of the results of potential flow theory and the known characteristics of turbulent vortex structure. Experimental data consisting of instantaneous velocity measurements obtained by means of a hot-wire anemometer system and information obtained from visual flow field studies are compared with the results of the theoretical analysis. Author (TAB)

N70-34105# Naval Postgraduate School, Monterey, Calif.
A THEORETICAL AND EXPERIMENTAL STUDY OF THE IMPINGEMENT OF TWO SUBSONIC JETS
Nihat Gungor (M.S. Thesis) Jun. 1969 114 p refs
(AD-705106) Avail: CFSTI CSCL 13/7

A theoretical and experimental investigation was performed on the determination of the characteristics of two impinging plane turbulent jets for the purpose of understanding the performance of proportional fluid amplifiers and momentum-exchange devices. The jet deflection angle was determined through the application of the free-streamline theory for two normally impinging jets with arbitrary throat widths and wall set-backs. The deflection angle and the velocity and turbulence distributions across and at various distances along the jet were determined through the use of a hot-wire anemometer system. The results are presented in terms of normalized parameters suitable for comparison with the theoretical predictions. The deflection angles predicted theoretically were found to be in good agreement with those obtained experimentally. Author (TAB)

N70-34139# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
THE CHOICE OF A TIME-DEPENDENT TECHNIQUE IN GAS DYNAMICS
Gino Moretti Jul. 1969 80 p refs
(Contract Nonr-839(34))
(AD-705514; PIBAL-69-26) Avail: CFSTI CSCL 20/4

A definition of the word technique, as related to numerical computations of time-dependent problems in gas dynamics, is given. Requirements of accuracy, economy and flexibility are considered. A technique which attempts to satisfy them is presented. Emphasis is put on the consistency of the numerical procedure with the physical problem. The concepts of consistency, convergence and truncation error are reexamined. The advantages of recasting the equations in divergence form are denied. Certain breakdowns in accuracy occurring in regions of continuous flow are explained. The physical role played by discontinuities and its numerical counterpart are discussed. Author (TAB)

N70-34170# Naval Research Lab., Washington, D.C. Mathematics Research Center.
SOME GENERAL PROPERTIES OF A CLASS OF SEMILINEAR HYPERBOLIC SYSTEMS ANALOGOUS TO THE DIFFERENTIAL-INTEGRAL EQUATIONS OF GAS DYNAMICS Final Report
Howard E. Conner 25 Feb. 1970 17 p refs
(AD-705999; Rept-70-4) Avail: CFSTI CSCL 20/13

The paper discusses the general structure of a class of semilinear hyperbolic systems analogous to the Boltzmann equation for a gas model with discretized velocity states, using a background of nonequilibrium theory for gas dynamics. The global existence of (nonnegative) solutions associated with nonnegative initial data is developed. Some auxiliary results on a linear conjugacy of systems and on monotonicity and smoothness properties of general (local) solutions are given. TAB

N70-34174# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BOUNDARY CONDITIONS FOR THE MOMENT EQUATIONS OF A RAREFIED GAS
R. G. Barantsev et al 25 Feb. 1970 12 p refs Transl. into ENGLISH from Vestn. Leningr. Univ. Ser. Mat. Mekhan. i Astronom. (USSR), v. 24, no. 1, 1969 p 92–101
(AD-703531; FTD-HT-23-101-70) Avail: CFSTI CSCL 20/4

Analysis of the relation between gasdynamics and Boltzmann equations in the description of the kinetic behavior of rarefied gases. The concept of physical and mathematical boundedness is applied in setting a boundary condition for the moment equations of such gases. A new type of boundary conditions is proposed for the Navier Stokes equations of a rarefied gas. Author (TAB)

N70-34183*# Translation Consultants, Ltd., Arlington, Va.
LAMINAR BOUNDARY LAYER IN A COMPRESSED GAS AT A GIVEN SURFACE TEMPERATURE AND IN THE

PRESENCE OF SUCTION [LAMINARNYY POGRANICHNYY SLOY V SZHIMAYEMOM GAZE PRI ZADANNOY TEMPERATURE POVERKHNOSTI I NALICHII OTSASYVANIYA]

L. F. Kozlov Washington NASA Apr. 1970 10 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), V. 5, no. 7, 1969 p 93–98
(Contract NASw-2038)
(NASA-TT-F-12965) Avail: CFSTI CSCL 20D

An approximate method is presented for calculating the characteristics of the laminar boundary layer in a compressed gas at a given surface temperature when suction of the gas through the permeable surface of the body is present. The method is applicable to a two-dimensional flow, but the same equation can be used in the case of axially symmetrical boundary layers on a body of revolution. Author

N70-34213# United Research Services, San Mateo, Calif.

HYDRODYNAMIC DATA FROM EXPLODING WIRES Annual Report

A. R. Kriebel and J. S. Bechtel 1 Apr. 1970 82 p refs
(Contract N00014-67-C-0451)
(AD-706074; URS-679-6) Avail: CFSTI CSCL 18/3

Hydrodynamic data are presented, and compared with previous data and theory, for a series of 41 nearly identical wires exploded between 4 in. above to 4 in. below the surface of a large volume of water under normal atmospheric pressure. Author (TAB)

N70-34567# California Univ., Livermore. Lawrence Radiation Lab.

DESCRIPTION OF THE PUFL FORTRAN PROGRAM

Leota Barr and Eleanor Reed 5 Jan. 1970 38 p refs
(UCRL-50802) Avail: CFSTI

The PUFL code (FORTRAN program) performs a gas dynamic calculation for a pipe flow with entrainment. The PUFL is used in the Plowshare program. The PUFL consists of a large number of nested subroutines which help to separate the code into natural, distinct units of logical control or calculation. The numerous subroutines exist because usually each addition to PUFL was attached as a subroutine to the running program. The PUFL has over 100 input variables all or part of which may be defined by the user. Author (NSA)

N70-34592# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

MIXING MOCK-UP STUDY OF THE SODIUM CHEMICAL TECHNOLOGY FACILITY SODIUM RESERVOIR

D. H. Lester and W. F. Smith Mar. 1970 39 p refs
(Contract AT(45-1)-1830)
(BNWL-1269) Avail: CFSTI

The possibility of using free jets to agitate 1200 F liquid sodium in a 1500 gal tank was investigated. Tracer tests were made in a 54 gal water model of the jet mixing tank using jets 0.26 to 0.38 in. diameters and flow rates from 4.4 to 8.8 gal/min. The impulse response of the tank was measured at the outlet and various internal points. Acceptable agitation over a wide range of flow rates was obtained. Author (NSA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-33401# Israel Program for Scientific Translations, Ltd., Jerusalem.

ATMOSPHERIC TRANSPARENCY IN THE VISIBLE AND THE INFRARED

V. E. Zuev 1970 223 p refs Transl. into ENGLISH of the book "Prozrachnost Atmosfery Dlya Vidimykh i Infrakrasnykh Luchei" Moscow, Izd. Sovetskoe Radio, 1966 Prepared for Dept. of Commerce and NSF
(TT-69-55102) Copyright. Avail: CFSTI

Quantitative data on absorption, scattering, and extinction of infrared and visible radiation in narrow frequency intervals for various sources, detector geometries, and a wide range of meteorological conditions are presented. These data can be directly applied to solve various problems which require knowledge of atmospheric transmittance parameters. Author

N70-33405# Israel Program for Scientific Translations, Ltd., Jerusalem.

TRANSFER OF MICROWAVE RADIATION IN THE ATMOSPHERE

K. S. Shifrin, ed. 1970 166 p refs Transl. into ENGLISH of the book "Perenos Mikrovolnovogo Izlucheniyav Atmosfere" Leningrad, Gidrometorologicheskoe Izd., 1968 Prepared for Dept. of Commerce and NSF
(TT-69-55104) Copyright. Avail: CFSTI

A collection of papers concerned with intrinsic atmospheric and terrestrial thermal radiation in the centimeter and millimeter spectral regions is presented. These works show that thermal radio frequency radiation contains information on ground temperature, ice fields of seas, atmospheric humidity, and cloud and precipitation zones. Author

N70-33419# RAND Corp., Santa Monica, Calif.

STUDIES IN CLIMATE DYNAMICS FOR ENVIRONMENTAL SECURITY: NUMERICAL STUDIES OF TRANSIENT PLANETARY CIRCULATIONS IN A WIND-DRIVEN OCEAN ON THE SPHERE

W. Lawrence Gates Apr. 1970 61 p refs
(Contracts DAHC 15-67-C-0141; NSF C-415; ARPA Order 189-1)
(AD-706035; RM-6211-ARPA) Avail: CFSTI CSCL 8/3

The paper presents a numerical investigation of a bounded ocean basin on the spherical earth, with particular attention directed to the role of planetary circulations. The time-dependent primitive equations are solved for a shallow, wind-driven, homogeneous ocean in a basin of uniform depth on the sphere. In a series of comparative numerical solutions, it is shown that at least a 2-degree resolution is needed to resolve the western boundary currents adequately and to avoid undue distortion of the transient Rossby waves. Although the transient Rossby waves systematically produce a momentum flux convergence at the latitude of the maximum eastward current, this is only a relatively small contribution to the zonal oceanic momentum balance; the bulk of the mean zonal stress is balanced by a nearly stationary net pressure torque exerted against the meridional boundaries by the wind-raised water. TAB

N70-33470# Dominion Observatory, Ottawa (Ontario).

RECORD OF OBSERVATIONS AT MEANOOK MAGNETIC OBSERVATORY 1949-1950

H. E. Cook, A. B. Cook, and R. G. Madill 1970 102 p /ts Publ. of the Dominion Obs., Vol. 83, No. 4
Avail: CFSTI

The mean hourly, daily and monthly values of horizontal intensity, declination and vertical intensity together with daily extreme and range values of these elements and their diurnal inequalities are given for the years 1949 and 1950. The monthly and yearly means of H, D, Z, X, Y and F are based on mean hourly values for H, D and Z. Values of X, Y, I and F are computed from H, D and Z. A list of mean annual values of the magnetic elements for the years 1917 to 1950 is included. Author

N70-33504# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, No. 229 26 May 1970 p 21–27 refs (See N70-33501 18-34)
Avail: CFSTI

Abstracts are presented on measurement of bioluminescence at maximum depths, alkaline augititic lavas from the Pacific Ocean floor, and research in marine oceanography, currents, and sea ice. R.B.

N70-33505# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, No. 299 26 May 1970 p 28–38 refs (See N70-33501 18-34)
Avail: CFSTI

Articles and abstracts are given on multilateral cooperation of Socialist countries in geophysics, Soviet work in geomagnetism and aeronomy, seismic study of areas of recent earth tremors in the Turkmen SSR, electron intensity in the outer radiation belt and indices of geomagnetic activity, the geoactivity of solar flares, the magnetic field of the neutral layer in the tail of the magnetosphere, the isostasy of the Bering Sea, structural elements of the Japanese-Sakhalin Island arc, attenuation of spheroidal oscillations in the earth, deep seismic sounding in the USSR, polar disturbances and geomagnetic pulsations, the use of transformed waves from deep-focus earthquakes, and seismic studies of the ocean crust. R.B.

N70-33506# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, No. 229 26 May 1970 p 39–62 refs (See N70-33501 18-34)
Avail: CFSTI

Summaries and abstracts are presented on the earth's radiation belts, color television from space, solar short wave radiation and ionospheric effects, launching of Cosmos and Meteor satellites, the use of space photographs in geology, electron concentration in the polar ionosphere, study of the F2 layer, periodic wind currents in the lower ionosphere, the dependence of plasma scale height on magnetic activity, the field strength of radio waves propagating over long distances, the development of a polar storm and elementary magnetic disturbances, phase measurement of extremely long-wave signals during eclipse, the use of rotors to control orientation and stabilization of earth satellites, the effect of moving disturbances on the drift of small F2 inhomogeneities, formation of the plasmapause in the earth's magnetosphere, the density of molecular oxygen at 80 to 160 km altitude, the use of satellite data on cloud cover, determining atmospheric moisture content by satellite, contrast of radio brightness temperatures of clouds and rain, determining sea surface temperature by satellite, and observation of cloud fields in the tropics from satellites. R.B.

N70-33546# National Oceanographic Data Center, Washington, D.C.
GUIDE TO SUBMISSION OF DATA. FIRST ISSUE: GENERAL GUIDELINES
Jul. 1969 23 p refs Sponsored in part by AEC, Dept. of Com., Dept. of Transportation, Navy, HEW, and NSF *Its* Tech. Bull. Ser., Publ. 8-1
(AD-704941; TB-1) Avail: CFSTI CSCL 8/1

To facilitate the flow of data into the national repository and to make them available to the general user, NODC is now shifting its emphasis from standard formats to a flexible twofold approach: (1) The originator may send data in his own format, which subsequently will be standardized, and the data will be incorporated into the National Marine Data Base through NODCs General Data System. (2) NODC will accept a greater variety of oceanographic material that does not readily lend itself to computerization. The Guide to Submission of Data seeks to define a set of general guidelines that should be considered in submitting data, analytical products, or information to NODC. Author (TAB)

N70-33548# Kakioka Magnetic Observatory (Japan).
MEMOIRS OF THE KAKIOKA MAGNETIC OBSERVATORY VOLUME 13, NO. 2
Mar. 1970 89 p refs In JAPANESE; ENGLISH summaries
Avail: CFSTI

CONTENTS:

1. ON EARTH-CURRENT VARIATIONS CAUSED BY THE PRESSURE ACTING UPON THE GROUND H. Oshima p 1–15 refs (See N70-33549 18-13)
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3. RESULT OF THE MAGNETIC SURVEY IN THE KAKIOKA MAGNETIC OBSERVATORY GROUND IN 1968 K. Ochi p 31–48 refs (See N70-33551 18-13)
4. ON CHARACTERISTICS OF GEOMAGNETIC VARIATION AT MATSUSHIRO M. Kon p 49–71 refs (See N70-33552 18-13)
5. ON THE RELATION BETWEEN THE SOLAR FLARE EFFECTS AND ASSOCIATED GEOMAGNETIC STORMS M. Nagai p 73–87 refs (See N70-33553 18-13)

N70-33549# Kakioka Magnetic Observatory (Japan).
ON EARTH-CURRENT VARIATIONS CAUSED BY THE PRESSURE ACTING UPON THE GROUND
Hiromi Oshima *In its* Mem. of the Kakioka Magnetic Obs., Vol. 13, No. 2 Mar. 1970 p 1–15 refs In JAPANESE; ENGLISH summary (See N70-33548 18-13)
Avail: CFSTI

The pressure was produced by trains with steam-engines running on the Joban line. Large changes above 20 mV in the earth-current potential was observed when the train passed by. No change was found in specific earth resistivity exceeding the relative measuring accuracy in the region where the train weight acted upon the ground effectively. The earth is assumed to be formed of a semi-infinite porous medium which is filled with water and the electric double layer is formed on the boundary between soil and water. When pressure acts upon the surface the water may move through narrow capillaries in the soil and streaming potentials may be generated. The streaming potential may cause leakage currents in the earth. Calculated potentials according to this consideration show good agreement with observed changes of the earth current potential. Author

N70-33550# Kakioka Magnetic Observatory (Japan).
RESULTS OF MAGNETIC SURVEY OF VOLCANOES AZUMA, ZAO AND KUSATSU-SHIRANE
Kou Ochi *In its* Mem of the Kakioka Magnetic Obs., Vol. 13, no. 2 Mar. 1970 p 17–29 refs In JAPANESE; ENGLISH summary (See N70-33548 18-13)
Avail: CFSTI

The surveys were carried out in 1966 and 1967. The purpose of the survey was to study the basic character of these volcanoes during calm periods. Observed dip values are shown for all survey points in three volcanoes and dip variations between each survey point in the Kusatsu-Shirane and Kakioka stations are compared. Recommendations are made for effective observation of future magnetic surveys of volcanoes. Author

N70-33551# Kakioka Magnetic Observatory (Japan).
RESULT OF THE MAGNETIC SURVEY IN THE KAKIOKA MAGNETIC OBSERVATORY GROUND IN 1968

Kou Ochi *In its* Mem. of the Kakioka Magnetic Obs., Vol. 13, No. 2 Mar. 1970 p 31–48 refs In JAPANESE; ENGLISH summary (See N70-33548 18-13)
Avail: CFSTI

The magnetic survey was conducted on the future site of a new standard magnetometer building. Some magnetic anomalies were found and are believed to be caused by the topography of the hill or by the buildings and equipment of the observatory. Although the surface of the ground at the center part of the hill is nearly flat, the magnetic field gradient is 10 to 20 G/10m. It is proposed that the ground be leveled and the buildings on or near the hill be removed before construction of the magnetometer building. Author

N70-33552# Kakioka Magnetic Observatory (Japan).
ON CHARACTERISTICS OF GEOMAGNETIC VARIATION AT MATSUSHIRO
Minoru Kon *In its* Mem. of the Kikioka Magnetic Obs., Vol. 13, No. 2 Mar. 1970 p 49–71 refs In JAPANESE; ENGLISH summary (See N70-33548 18-13)
Avail: CFSTI

Geomagnetic observations were carried out of the Matsushiro Seismological Observatory to compare the geomagnetic variations at Matsushiro with those at Kakioka. Characteristics at Matsushiro are similar to those at Kakioka in general, except that amplitudes of rapid variation in the vertical component at Matsushiro are less than half of those at Kakioka. It is noted that the ratio for the short period variation is about 1.6. Author

N70-33553# Kakioka Magnetic Observatory (Japan).
ON THE RELATION BETWEEN THE SOLAR FLARE EFFECTS AND ASSOCIATED GEOMAGNETIC STORMS
M. Nagai *In its* Mem. of the Kakioka Magnetic Obs., Vol. 13, No. 2 Mar. 1970 p 73–87 refs In JAPANESE; ENGLISH summary (See N70-33548 18-13)
Avail: CFSTI

It has been suggested that the occurrence of a solar flare effect (SFE) in a magnetogram is an indication that the flare is capable of producing a magnetic storm which will usually follow within 2 or 3 days. Evidence is examined which suggests that either there is no increase of magnetic activity due to a SFE or that the increase is a significant event. A statistical investigation of the connection between SFE and magnetic storms shows positive results in 32% of SFE, with an increase of magnetic activity within 4 days. Author

N70-33559# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 227 30 Apr. 1970 p 28–34 (See N70-33556 18-34)
Avail: CFSTI

News releases of oceanographic activities, and summaries of published articles are presented. Topics include thickness of drifting ice, salt exchange between ocean and atmosphere, and deep currents. F.O.S.

N70-33560# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 227 30 Apr. 1970 p 35–45 (See N70-33556 18-34)
Avail: CFSTI

Abstracts of published articles on terrestrial geophysics are presented. Topics include range finding, seismic soundings, ionospheric disturbances and geotectonics. F.O.S.

N70-33575# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 226 14 Apr. 1970 p 32–45 (See N70-33572 18-34)
Avail: CFSTI

Oceanographic news releases are summarized from Soviet research vessels near Labrador and the Sea of Japan. A method developed for processing wave measurements at shallow depths using a small Setun computer is reviewed. Abstracts are also included on oceanographic literature. J.A.M.

N70-33578# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space No. 226 14 Apr. 1970 p 46–51 (See N70-33572 18-34)
Avail: CFSTI

A news release from a volcanologists conference is summarized, including volcanism relationships to earth's interior, petrology and geochemical studies of volcanic products, and the formation and use of ore mineralization and thermal water. Abstracts are also included on various geophysical literature. J.A.M.

N70-33611# Naval Postgraduate School, Monterey, Calif.
CONTINENTAL SHELF WAVES OVER A CONTINENTAL SLOPE
Henry Dixon Sturr, Jr. (M.S. Thesis) Oct. 1969 62 p refs
(AD-706011) Avail: CFSTI CSCL 8/3

A numerical study is made of the effect of a continental slope and shelf of finite width on trapped shelf and edgewaves. A comparison is made between a numerical solution for a continental shelf of finite width and its simplified analytic solution. It is shown that certain modes of these quasigeostraphic waves can undergo exponential growth or decay under special conditions. Author (TAB)

N70-33658*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
POSSIBLE GEOPOTENTIAL IMPROVEMENT FROM SATELLITE ALTIMETRY
C. A. Lundquist, G. E. O. Giacaglia, K. Hebb, and S. G. Mair 10 Feb. 1969 104 p refs
(Contract NSR-09-015-054)
(NASA-CR-109787; SAO-Special-Rept-294) Avail: CFSTI CSCL 08N

CONTENTS:
1. POSSIBLE GEOPOTENTIAL IMPROVEMENT FROM SATELLITE ALTIMETRY C. A. Lundquist and G. E. O. Giacaglia (Sao Paulo Univ., Brazil) p 3–44 refs (See N70-33659 18-13)
2. NUMERICAL DEFINITION OF LOCALIZED FUNCTIONS ON A SPHERE K. Hebb and S. G. Mair p 47–98 (See N70-33660 18-19)

N70-33659*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
POSSIBLE GEOPOTENTIAL IMPROVEMENT FROM SATELLITE ALTIMETRY
C. A. Lundquist and G. E. O. Giacaglia (Sao Paulo Univ., Brazil)
In its Possible Geopotential Improvement from Satellite Altimetry 10 Feb. 1969 p 3–44 refs (See N70-33658 18-13)
Avail: CFSTI CSCL 08N

A numerical solution for satellite-to-ocean latitudes using functions on a sphere, coefficients of geopotential, and functions of one variable is studied. Altitude observations yielded equations for improving satellite orbits and geopotential representation. Laser tracking from ground stations was found useful to combine with altitude data. It is concluded that satellite-to-ocean altitude promises substantial data in a form that can be analyzed without undue difficulty. J.A.M.

N70-33678# System Development Corp., Santa Monica, Calif.
NATIONAL DATA PROGRAM FOR THE MARINE ENVIRONMENT, VOLUME 1, PHASE 2 Final Report
31 Jul. 1969 517 p refs
(Contract N00014-67-C-0559)
(AD-699125; TM-4023/005/00) Avail: CFSTI CSCL 5/2

Contents: Description of the current marine data network. Analysis of current and future requirements. Delineation of priority marine data and products. Requirements and impact of techological change on marine data management. Evaluation of alternatives for improved marine data management and summary of technical development plan. TAB

N70-33679# System Development Corp., Santa Monica, Calif.
NATIONAL DATA PROGRAM FOR THE MARINE ENVIRONMENT: VOLUME 2: TECHNICAL DEVELOPMENT PLAN, PHASE 2 Final Report
31 Jul. 1969 231 p
(Contract N00014-67-C-0559)
(AD-699126; TM-4023/006/00) Avail: CFSTI CSCL 5/2

Contents, objectives, scope, and methodology. Summary of the technical development plan, agency development plans - Great Lakes and coastal development and marine data network development plans. TAB

N70-33683# Technische Hochscule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
PETROGRAPHIC AND METAMORPHOLOGICAL STUDIES AT THE WESTERN END OF THE SCHNEEBERGER MOUNTAIN RANGE (SOUTHERN OETZTAL CRYSTALLINE) [PETROGRAPHISCHE UND GEFUEGEKUNDLICHE UNTERSUCHUNGEN AM WESTENDE DES SCHNEEBERGER ZUGES (SUEDLICHES OETZTALKRISTALLIN)]
Peter Helbig (Ph.D. Thesis) 11 Jun. 1969 26 p refs In GERMAN
Avail: CFSTI

Petrographic metamorphic studies on mica shifts of the Laaser series in the Schneeberger mountain range did not establish any mineral facet differences; stratigraphic horizontal layers as well as some marble strata changed from one series into the other. The metamorphic and tektonic history of the Schneeberger mountain range establishes its Oetztal crystalline structure through: (1) a complex loop formation in the southern Oetztal crystalline; and (2) the dominance of marble, mica shist, and quartzite in contrast to biotite-plagioclase gneissic formation. Marble is only found locally in the rest of the Oetztal formation. Transl. by G.G.

N70-33691# Ionospharen-Institut Breisach (West Germany).
IONOSPHERIC DATA. VERTICAL ECHO SOUNDING: FREIBURG URSI-CODE 131, APRIL 1970 [IONOSPHAEREN-DATEN. VERTIKAL-ECHO-LOTUNG: FREIBURG URSI-CODE 131, APRIL 1970]
Apr. 1970 42 p In ENGLISH and GERMAN
(Rept-286-F) Avail: CFSTI

Daily summaries of vertical echo sounding of the upper atmosphere are presented for April 1970. The data include charts of median values for the E and F regions. MUF(3000)F2, M(3000)F2, h'F2, hpF2, foF1, MUF(3000)F1, M(3000)F1, h'F, foE, foE2, h'E, foEs, fbEs, h'Es, Type Es, foT, and fmin. R.B.

N70-33704# Joint Publications Research Service, Washington, D.C.
ELECTROMAGNETIC PHENOMENA IN THE SEA
V. V. Shuleykin, ed. 27 Mar. 1970 115 p refs Transl. into ENGLISH from the book "Elektromagnitnyye Yavleniya v More," Vol. 40 Kiev, Naukova Dumka Press, 1968 p 1-21, 37-123, and 146-151
(JPRS-50173) Avail: CFSTI

CONTENTS:

1. GYROCOMPASS FOR MAGNETOMETRIC OPERATIONS IN THE SEA N. I. Sigachev p 1-8 refs (See N70-33705 18-14)

2. PROBLEM OF MEASURING THE MAGNETIC FIELD IN THE SEA BY TONED MAGNOMETERS D. L. Finger p 9-20 refs (See N70-33706 18-13)

3. ERRORS OF THE FERROSONDE COMPONENT OF A MAGNETOMETER FOR SMALL DEVIATION ANGLES OF THE Z AND H SENSORS AND COMPENSATION FOR THEM N. N. Karnaushenko p 21-30 refs (See N70-33707 18-14)

4. TIDAL VARIATION OF THE GEOMAGNETIC FIELD ON KHEYSA ISLAND (FRANZ JOSEF LAND) V. S. Shneyer p 31-34 refs (See N70-33708 18-13)

5. SHOCK WAVES IN INTERPLANETARY SPACE AND SUDDEN COMMENCEMENT OF MAGNETIC STORMS A. S. Dvoryashin p 35-53 refs (See N70-33709 18-13)

6. GEOMAGNETIC PERTURBATIONS WITH SUDDEN COMMENCEMENT AND THE TROPOSPHERIC TEMPERATURE FIELD DURING ABATEMENT OF SOLAR ACTIVITY R. B. Smirnov p 54-61 refs (See N70-33710 18-13)

7. DISTRIBUTION OF THE TELLURIC FIELD IN AN INLAND SEA V. I. Lopatnikov p 62-73 refs (See N70-33711 18-13)

8. ELECTROTELLURIC FIELD DISTRIBUTION IN THE SHELF ZONE OF THE SEA N. I. Lopatnikov p 74-91 refs (See N70-33712 18-13)

9. A FORM OF NOISE OBSERVED WHEN MEASURING TELLURIC CURRENTS IN THE SEA G. A. Fonarev p 92-94 ref (See N70-33713 18-13)

10. VERTICAL DISTRIBUTION OF THE NATURAL ELECTRIC FIELD IN THE OCEAN R. M. Demenitskaya et al p 95-102 refs (See N70-33715 18-13)

11. EFFECT OF ELECTRODES ON ELECTRIC FIELD MEASUREMENTS IN SEAWATER V. N. Mitrofanov p 103-107 refs (See N70-33715 18-13)

12. RESOLUTIONS OF THE SCIENTIFIC AND TECHNICAL CONFERENCE ON ELECTROMAGNETIC PHENOMENA IN THE SEA p 108-111 refs (See N70-33716 18-13)

N70-33706# Joint Publications Research Service, Washington, D.C.
PROBLEM OF MEASURING THE MAGNETIC FIELD IN THE SEA BY TOWED MAGNOMETERS
D. L. Finger *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 9-20 refs (See N70-33704 18-13)
Avail: CFSTI

A survey is presented on measuring the magnetic field in the ocean by towed magnetometers, and the problem of considering geomagnetic variations during magnetic recording at sea is investigated. The measurements are made by sensors towed outside the magnetic field of a ship, and are useful in prospecting for minerals and for navigation. R.B.

N70-33708# Joint Publications Research Service, Washington, D.C.
TIDAL VARIATION OF THE GEOMAGNETIC FIELD ON KHEYS ISLAND (FRANZJOSEF LAND)
V. S. Shneyer *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 31-34 refs (See N70-33704 18-13)
Avail: CFSTI

The causes of the anomalous diurnal variation of the vertical component of the magnetic field on Kheys Island in the Western Arctic were investigated. It was proposed that a field induced by the marine tidal currents is superimposed on the SD-variation. The Chapman-Bertels method was used in isolating the tidal variation of the magnetic field and hourly tables of the variations of the three magnetic components were developed. R.B.

N70-33709# Joint Publications Research Service, Washington, D.C.

SHOCK WAVES IN INTERPLANETARY SPACE AND SUDDEN COMMENCEMENT OF MAGNETIC STORMS

A. S. Dvoryashin *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 35-53 refs (See N70-33704 18-13)

Avail: CFSTI

In considering the causes for the field increase during sudden commencement of magnetic storms, the detected shock waves are divided into two classes of field discontinuity before recurrent magnetic storms and field discontinuity before storms connected with solar flares. Solar and geomagnetic data and measurements of the polarity of the interplanetary magnetic field obtained by the IMP-1 satellite are used to identify the active regions emitting recurrent fluxes. The measurements indicate that the sudden commencement is caused by passage of the earth through the front of a collisionless shock wave induced by a solar flare. The sudden commencement recordings are used to estimate the width of the shock wave front. R.B.

N70-33710# Joint Publications Research Service, Washington, D.C.

GEOMAGNETIC PERTURBATIONS WITH SUDDEN COMMENCEMENT AND THE TROPOSPHERIC TEMPERATURE FIELD DURING ABATEMENT OF SOLAR ACTIVITY

R. B. Smirnov *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 54-61 refs (See N70-33704 18-13)

Avail: CFSTI

The phenomena in the troposphere connected with sudden commencement of magnetic storms are investigated. Such perturbations with high intensity are usually connected with chromospheric eruptions of force 2 and higher. Sudden onset of less intense storms may correspond to the forward section of the quasistationary sector of the interplanetary field. The investigation uses the temperature field of the ground layer of the troposphere in the coastal regions of the Black Sea as the tropospheric object. The types of geomagnetic disturbance are compared. R.B.

N70-33711# Joint Publications Research Service, Washington, D.C.

DISTRIBUTION OF THE TELLURIC FIELD IN AN INLAND SEA

V. I. Loptnikov *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 62-73 refs (See N70-33704 18-13)

Avail: CFSTI

A method investigated for calculating the horizontal distribution of the electrotelluric field in an inland sea. The problem is considered as the effect of the sea on the horizontal distribution of the electrotelluric field with respect to the surface as a function of other geological factors. The stationary problem of finding the electrotelluric field distribution in the region which is external with respect to the line of the continental slope is formulated as the problem of two-dimensional distribution of the field where the continental slope line itself is taken as the equipotential line. R.B.

N70-33712# Joint Publications Research Service, Washington, D.C.

ELECTROTELLURIC FIELD DISTRIBUTION IN THE SHELF ZONE OF THE SEA

V. I. Lopatnikov *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 74-91 refs (See N70-33704 18-13)

Avail: CFSTI

The problem of two-dimensional distribution of the potential electric field near the recess in a conducting half plane with a surface current or near a cylindrical depression in a conducting half space with a current is considered. The interface of such a shape approximates the continental slope line for the Crimean coast and can be considered as one of the standard morphological elements of continental outlines. The results of the investigations can be used to interpret natural observations of the electrotelluric field in the shelf zone of the sea and in coastal regions. R.B.

N70-33713# Joint Publications Research Service, Washington, D.C.

A FORM OF NOISE OBSERVED WHEN MEASURING TELLURIC CURRENTS IN THE SEA

G. A. Fonarev *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 92-94 ref (See N70-33704 18-13)

Avail: CFSTI

The noise induced by oscillatory motion of the measuring lines in water when measuring telluric currents in the sea is investigated. The oscillatory motion is believed to be caused by nonuniform drift of the ice floe, the motion of which is determined by the force and direction of the wind. R.B.

N70-33714# Joint Publications Research Service, Washington, D.C.

VERTICAL DISTRIBUTION OF THE NATURAL ELECTRIC FIELD IN THE OCEAN

R. M. Demenitskaya et al *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 95-102 refs (See N70-33704 18-13)

Measuring equipment and techniques used for well potential logging in wells was applied to study of the vertical distribution of the natural electric field in the ocean. The natural electric field is defined as the quasistationary component of the natural polarization of water masses caused by physicochemical process in the medium studied and by the dynamics of the water masses in the magnetic field of the earth. The studies show that the vertical distribution is determined by the structure of the current field, the diffusion potential, and the bioelectric effect. R.B.

N70-33715# Joint Publications Research Service, Washington, D.C.

EFFECT OF ELECTRODES ON ELECTRIC FIELD MEASUREMENTS IN SEAWATER

V. N. Mitrofanov *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 103-107 refs (See N70-33704 18-13)

Avail: CFSTI

The effect of electrochemical processes occurring at the electrode-medium interface is investigated. The signal taken from the electrodes is determined by the measurable electric field and by the characteristic emf of the electrodes and their polarization. The study shows that the effect of the electrodes on measurements of the electric field in the sea can be estimated independently of purposes and procedures. R.B.

N70-33716# Joint Publications Research Service, Washington, D.C.

RESOLUTIONS OF THE SCIENTIFIC AND TECHNICAL CONFERENCE ON ELECTROMAGNETIC PHENOMENA IN THE SEA

In its Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 108-111 refs Conf. held at Sevastopol, Ukr. RSR, 22-26 Sep. 1966 (See N70-33704 18-13)

Avail: CFSTI

Reports were presented at the conference on the modern theory of electromagnetic field formation under marine and oceanic conditions, equipment and procedures for conducting observations at sea, and problems concerning the origin of the variable terrestrial electromagnetic field. Resolutions were passed which call for

increased development of research on electromagnetic phenomena in the sea and establishment of a coordinated and unified research program. R.B.

N70-33719# Naval Postgraduate School, Monterey, Calif.
DESIGN AND CONSTRUCTION OF A DATA RECORDING AND PROCESSING SYSTEM FOR GEOMAGNETIC FIELD COHERENCE STUDIES
Gert-Wolfgang Huelsekopf (M.S. Thesis) Dec. 1969 41 p refs
(AD-706012) Avail: CFSTI CSCL 8/14

The design and construction of a data recording and processing system is described which permits simultaneous measurements from three proton free-precession magnetometers to be written onto tape at two second intervals. Detailed circuit diagrams and a computer program used for de-bugging the magnetic tape output are presented. Author (TAB)

N70-33727# Institute for Telecommunication Sciences, Boulder, Colo.
RECOMMENDED SPECIFICATIONS FOR IONOSPHERIC CHANNEL AND ATMOSPHERIC NOISE SIMULATORS
C. C. Watterson and R. M. Coon Sep. 1969 23 p refs
(ESSA-ERL-127-ITS-89) Avail: SOD $0.35

The many advantages in the use of ionospheric simulators in laboratory experiments with communication systems over similar on-the-air tests are discussed. Descriptions are given of an ionospheric channel model and an atmospheric noise model whose validities and accuracies were previously experimentally verified at high frequencies. Recommended numerical specifications are presented for ionospheric channel simulators and atmospheric noise simulators based on the verified models. Author

N70-33736*# Stanford Univ., Calif. Remote Sensing Lab.
DETAILED GROUND STUDY OF 8-13 MICRON INFRARED IMAGERY, CARRIZO PLAINS, CALIFORNIA
Robert W. Campbell, Jr., Lawrence D. Hoover, and Francisco Querol-Sune Jan. 1970 72 p refs
(Contract NAS9-7313)
(NASA-CR-108493; TR-70-1) Avail: CFSTI CSCL 08G

A field study of the Carrizo Plains area, central California, was undertaken over a 48-hour period from May 31 to June 1, 1969, to check in detail the causes of the dark (cold) thermal anomalies associated with the San Andreas fault trace as previously detected 4 years earlier on thermal infrared (the 8-13 micron band) imagery. Radiometric and contact ground temperatures showed a strong negative correlation with moisture content of the near-surface soil. The original anomaly on the imagery was also redetected and further defined by the ground temperature measurements. The NE side of the fault trace had a higher soil moisture content, and a correspondingly lower temperature than the SW side. Radiometric temperatures were consistently lower than contact ground temperatures. Several effects related to this variation are discussed. Humidity, topography, vegetation cover, and time of night influence the temperatures obtained. Author

N70-33789# Air Force Cambridge Research Labs., Bedford, Mass.
POSITIVE ION COMPOSITION MEASUREMENTS IN THE LOWER IONOSPHERE DURING THE 12 NOVEMBER 1966 SOLAR ECLIPSE
Rocco S. Narcisi, Alan D. Bailey, and Louis E. Della Lucca Apr. 1970 15 p refs Presented at the 3rd Aeronomy Conf., Urbana, Ill., 23-26 Sep. 1968 Sponsored by DASA
(AD-705540; AFCRL-70-0209; PSRP-416) Avail: CFSTI CSCL 4/1

Positive ion composition measurements in the D and E regions were performed on three rocket flights during the 1966 solar eclipse program conducted at Cassino, Brazil. The E region results showed that, at totality, NO+ and O2+ decreased in density while the ratio NO+/O2 increased. Long-lived meteoric ions appeared to be unaffected during the short period of the eclipse. A submerged layer of meteoric ions became prominent at totality when the molecular ion densities were smallest and produced a sporadic E layer. The D region results indicated that the decay in the water cluster ions at totality was probably less than a factor of four in the vicinity of 80 km. This work represents part of a continuing Air Force program to study lower ionospheric processes which affect communications. Author (TAB)

N70-33811# Stanford Univ., Calif. Dept. of Civil Engineering.
COMPUTER STUDIES OF FINITE-AMPLITUDE WATER WAVES
Robert K.-C. Chan, Robert L. Street and Theodor Strelkoff Jun. 1969 97 p refs
(Contract Nonr-225(71); Grant NSF GK-2506)
(PB-189522; W70-04009; B-037-CAL(4); TR-104) Avail: CFSTI CSLC 20D

Two numerical techniques were used to study the motion of two-dimensional, finite-amplitude water waves by using an electronic digital computer. The nonlinear properties of water waves are of primary interest. The Stanford-University-Modified MAC (SUMMAC) code which is proposed as a valid tool for analyzing incompressible, viscous flows with a free surface under transient conditions is introduced. The method is applied to the study of the solitary wave run-up on a vertical wall. The results are compared with the available experimental data and give a much better prediction of the wave run-up than the existing analytic theory. Newton's process of successive corrections is applied to solve steady-state potential flows with free surface and gravity. A specific application to the analysis of solitary waves is made and all the wave characteristics are in excellent agreement with experiments. Author (USGRDR)

N70-33869# Agricultural Research Service, Ithaca, N.Y.
THE ENERGY BUDGET AT THE EARTH'S SURFACE: BASIC CONCEPTS OF SPECTRAL ANALYSIS BY DIGITAL MEANS Interim Report No. 69-2
B. A. Kimball Nov. 1969 73 p refs Prepared in cooperation with Cornell Univ.
(Army Order 2-68)
(AD-705634; USDA-ARS-SWC-405; USDA-ARS-SWC-406; CU-RR-870; CU-RR-870A et al) Avail: CFSTI CSCL 2/3

An instrument to measure the rate of gas movement from beneath the surface of soil or other porous media was constructed. Subsequent measured rates of gas movement from beneath surface coverings of coarse and fine gravel, very coarse and medium sand, Chenango silt loam and straw were correlated against concurrent measurements of wind and air pressure fluctuations. At a depth of 2 cm gas movement in silt loam was not significantly affected by air turbulence but in coarse gravel was increased 10-fold by wind velocities of 400 cm/sec. Intermediate effects were observed for media of intermediated pore sizes. Mathematical equations for calculation of soil air mass flow are derived. They are based upon the spectrum of air pressure fluctuations at the ground surface. Air pressure in the field was measured during both day and night with and without a corn crop. The spectra of air pressure were calculated and all were roughly straight lines with a slope of about -8/3 on a log-log plot. Spectral density decreased from 10 to th 8th power to 0.10 sq microbar/cycle/sec over a frequency range from 0.0001 to 100 cycle/sec. Soil air mass flow was calculated from the spectra for several soils. Using previous work, an attempt was made to evaluate the increase of soil gas movement beyond diffusion from the soil air mass flow. Author (TAB)

N70-33877# Air Force Cambridge Research Labs., Bedford, Mass.
PULSE SOUNDING WITH CLOSELY SPACED RECEIVERS AS A TOOL FOR MEASURING ATMOSPHERIC MOTIONS AND FINE STRUCTURE IN THE IONOSPHERE. 3: THE APPLICATION OF THE GENERALIZED CORRELATION AND CROSS SPECTRAL ANALYSIS TO THE MODEL OF TURBULENT DRIFT Interim Report
W. Pfister Mar. 1970 20 p refs
(AD-705539; AFCRL-70-0185; ERP-317) Avail: CFSTI CSCL 4/1

The fading of reflected pulses received at three closely-spaced antennas can be analyzed with a correlation method. If the records contain rf phase fluctuations as well as amplitude fluctuations, a generalized correlation analysis is appropriate as well as a generalized cross spectral analysis. If it can be assumed that the fading is caused by turbulent drift at the reflection level, the analysis will result in certain relationships which are characteristic for the model. For example, the phase change of the cross-power spectrum will be proportional to frequency. The report contains Part III as a continuation of Parts I and II previously presented by Pfister and Bibl (1968). In this report, the formulas for handling amplitude and phase data with the generalized correlation and spectral analysis are given. Samples of measured auto-correlation and power spectra are presented, and a method for reducing the data in terms of a turbulent spectrum is indicated. Author (TAB)

N70-33891# Lamont Geological Observatory, Palisades, N.Y.
ANALYSIS OF SEISMIC DATA FROM THE AFRICAN CONTINENT Final Report, 1 Apr. 1966 – 31 Mar. 1969
Henry James Dorman 15 Apr. 1970 10 p
(Contract AF 49(638)-1723; ARPA Order 292 32)
(AD-705660; AFOSR-70-1169TR) Avail: CFSTI CSCL 17/10

A three-component high-gain, wide-band, long-period seismograph system was operated in Africa at Abeche, Chad. The installations provided high-quality recordings for many studies directly applicable to the VELA-UNIFORM program. The report gives a concise account of the work done at Abeche and the published results of that work. Author (TAB)

N70-33922# Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
SOME STATISTICAL PROPERTIES OF DENDRITIC CHANNEL NETWORKS
W. C. Krumbein and Ronald L. Shreve Apr. 1970 119 p refs
(Contract Nonr-1228(36))
(AD-705625; TR-13) Avail: CFSTI CSCL 5/10

Quantitative geomorphic measurements were made on modern 1:24,000-scale topographic maps for 90 order-3 and 90 magnitude-10 basins randomly selected from a 250 square-mile area of horizontal, homogeneous sandstones in eastern Kentucky. Operator variations were greatest in locating sources and least in measuring areas, and were readily reduced to acceptable limits by training and practice. Similar measurements were made on 153 magnitude-5 basins in the study area. The sample is approximately topologically random with weak, but apparently systematic, deviation. Author (TAB)

N70-33955*# Illinois Univ., Urbana. Aeronomy Lab.
MEASUREMENT OF AVERAGE ELECTRON DENSITY BETWEEN 75 AND 80 KILOMETERS
D. A. Reynolds and C. F. Sechrist, Jr. 1 May 1970 86 p refs
(Grant NGR-14-005-013)
(NASA-CR-109850; Rept-36) Avail: CFSTI CSCL 04A

Instrumentation capable of recording variables necessary for the computation of average electron density between 75 and 80 km was developed. The instrumentation is used in conjunction with the existing partial-reflection facility. Data output of the instrumentation is recorded on paper tape in binary coded decimal form. To handle the paper tape, a program was developed which produces for each data acquisition interval a mean electron density at 77.5 km and data necessary for a time plot of electron density at 77.5 km. Author

N70-33973*# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
DEPARTMENTS OF AEROSPACE ENGINEERING, METEOROLOGY AND OCEANOGRAPHY Final Report, 1 Mar. 1963 – 30 Jun. 1969
30 Jun. 1969 11 p refs
(Contract NASr-54(05))
(NASA-CR-109885; Rept-05627-25-F) Avail: CFSTI CSCL 04A

The activities and publications of a research program in upper atmospheric physics is summarized. Rocket measurements of the structure of the neutral atmosphere are emphasized. A comparison of neutral nitrogen was made among three nighttime mass spectrometer flights flown at different latitudes. The six-channel turret photometer was completed and preliminary tests were run using the night sky as a known signal source. The HARP photoelectron differential energy analyzer was tested on the vacuum system and proved to be capable of determining the photoelectron energy spectrum with a resolution of 10, as desired. Author

N70-34026 National Lending Library for Science and Technology, Boston Spa (England).
STRUCTURE OF THE UPPER PART OF CRYSTALLINE CRUST IN THE AREA OF THE OVRUCH SYNCLINORIUM ON THE BASIS OF SEISMIC DATA [STROENIE VERKHNEI CHASTI KRISTALLICHESKOI KORY V RAIONE OVRUCHSKOGO SINKLINORIYA PO SEISMICHESKIM DANNYM]
V. G. Sollogub et al Apr. 1970 19 p refs Transl. into ENGLISH from Geofiz. Sb., Akad. Nauk Ukr. SSSR (Ukrania SSR), v. 1, no. 12, 1965 p 18 – 26
(NLL-RTS-5548) Avail: Natl. Lending Library, Boston Spa, Engl.: 22s 6d or 2 NLL photocopy coupons

Depths of various layers of the earth's crust including the mineral content are studied, as well as precambrian strata depths. The elastic similarity between the Ovruch series and the Korosten and Perga granites are shown. The velocity of elastic wave propagation in the upper part of the crystalline crust was found to increase gradually with increasing depth. About 5 km in the crystalline strata, a sloping seismic boundary is examined, corresponding to the surface of basic composition rocks. J.A.M.

N70-34055# Naval Oceanographic Office, Washington, D.C.
FUNCTIONS OF THE DISTRIBUTION OF WAVE COMPONENTS IN SHALLOW WATER [FUNKTSII RASPREDELENIYA ELEMENTOV VOLN NA MELKOVODE]
I. S. Brovikov 1970 13 p refs Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (Moscow), v. 50, 1960 p 39 – 44
(AD-705833; NOO-Trans-237) Avail: CFSTI CSCL 8/3

The functions of the distribution of wind wave components are derived by taking into consideration the bottom depth of basin and the mean values for a deep liquid. Author (TAB)

N70-34123# Air Force Cambridge Research Labs., Bedford, Mass.
OPEN DISCUSSION ON THE THEORY OF OBTAINING ATMOSPHERIC DENSITY VALUES
In its Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns, Apr. 1968 p 213 – 249 refs (See N70-34108 18-20)
Avail: CFSTI

The derivation of equations used to obtain atmospheric densities from meteor returns is presented. The single station technique is outlined, and the use of Fresnel zones patterns, effects of plasma resonance, electron diffusion, trail decay rates, effects of gravity waves, density versus decay height, and associated problems are discussed. N.E.N.

N70-34124# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DENSITY MEASUREMENTS OF HAVANA
Richard B. Southworth *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 251–262 (See N70-34106 18-20)
Avail: CFSTI

Atmospheric density and density height measurements using meteor trail returns are briefly described, and data collected on systems in operation are given. Diffusion heights correlated to meteors, data analysis, and curve fitting problems are covered. N.E.N.

N70-34126# Centre National d'Etudes Des Telecommunications, Issy-les-Moulineaux (France).
DENSITY VERSUS HEIGHT
Issac Revah *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 271–274 (See N70-34106 18-20)
Avail: CFSTI

The height deduced from the exponential decay of underdense echoes from meteors is compared to the height measured by the Garchy radar. The data are graphed and discussed. N.E.N.

N70-34127# Stanford Univ., Calif.
ADDITIONAL THOUGHTS
Allen M. Peterson *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 275–279 (See N70-34106 18-20)
Avail: CFSTI

The possibility of obtaining radar echo data on meteor trails at greater heights using lower frequencies is described. With 30 MHz the cutoff height is about 105 km. Difficulties in using lower frequencies are discussed, and include frequency assignment, ionospheric propagation of noise (mainly from lightning), daytime D region absorption, backscatter from the earth's surface, and Doppler shifts. N.E.N.

N70-34128# National Research Council of Canada, Ottawa (Ontario).
THE WORK AT OTTAWA
Peter M. Millman *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 281–283 refs (See N70-34106 18-20)
Avail: CFSTI

The investigations of the physics and science of meteor phenomena are reviewed. A 20 kW radar at 32 MHz with an omnidirectional antenna system is used to patrol 24 hours a day, and attempts are made to maintain a constant operating level. A 3-4 MW radar, also operating at 32 MHz with an omnidirectional antenna system, is used at the time of special showers and occasionally at the dark of the moon. The observation of radar echoes of bright meteors from three stations is also mentioned. N.E.N.

N70-34129# Georgia Inst. of Tech., Atlanta.
THE ADELAIDE PROGRAM
Robert G. Roper *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 285–286 ref (See N70-34106 18-20)
Avail: CFSTI

Future programs are summarized. Atmospheric turbulence studies in the meteor region, D and E layer backscatter measurements, meteor orbit determinations, time correlations determined from wind measurements, and atmospheric density irregularities measured with a laser radar are mentioned. N.E.N.

N70-34140# Naval Postgraduate School, Monterey, Calif.
AN ITERATIVE PROCESS TO SOLVE THE GRAPH-COLORING PROBLEM
Dennis Spencer Read (M.S. Thesis) Oct. 1969 44 p refs
(AD-705082) Avail: CFSTI CSCL 8/2

The intent of this paper is to describe a method of coloring a map and to present an algorithm for the solution of this problem. A computer program was developed to provide solutions to the problem of coloring a map which consists of a finite number of areas. This algorithm may also be applied to problems other than map-coloring. Author (TAB)

N70-34201# Alaska Univ., College. Inst. of Marine Science.
A VARIABLE-BOUNDARY NUMERICAL TIDAL MODEL
John C. H. Mungall and J. B. Matthews Mar. 1970 170 p refs
(Contract Nonr-3010(05))
(AD-705610; R70-4) Avail: CFSTI CSCL 8/8

A numerical tidal model using equations developed by Hansen (1952) and Yuen (1967) is automated to the point where the potential user need not undertaken extensive reprogramming. The user adds to the program only those cards needed to specify tides at input points as a function of time; the application of the relevant calculations at each grid point being controlled by an integer matrix that corresponds to the inlet boundary. A sample problem is covered in detail and applications of the model to the M2 tide of the Gulf of California and to a hypothetical mean tide in Cook Inlet are shown. Author (TAB)

N70-34209# Naval Oceanographic Office, Washington, D.C.
SEICHES IN THE CASPIAN SEA [O SEYSHAKH V KASPIYSKOM MORE]
G. V. Polukarov 1970 17 p refs Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (Moscow), v. 50, 1960 p 45–53
(AD-705834; NOO-Trans-238) Avail: CFSTI CSCL 8/3

The analysis made it possible to find the upper boundary for the spectrum of periods of free oscillations of the Caspian Sea level. The greatest period appeared to equal 18 days. The paper points out that the most probable main period of free oscillations of the sea level must equal 12 hours. The determination of nodal lines is shown by examples; one of the lines, corresponding to the main period of oscillations of seiches, lies approximately in the Apsheronskiy Porog area. Author (TAB)

N70-34236# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICLE-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, FEBRUARY 1970 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, FEBRUAR 1970]
Feb. 1970 44 p In GERMAN and ENGLISH
(Rept-284-F) Avail: CFSTI

Daily summaries are presented for vertical echo sounding of the upper atmosphere during February 1970. The data include charts of median values for the E and F regions, MUF(3000)F2, M(3000)f2, h'F2, hpF2, foF1, MUF(3000)F1, M(3000)F1, h'F, foE, foE2, h'E, foEs, fbEs, h'Es, Type Es, foT, and fmin. R.B.

N70-34237# Ionospharen-Institut Breisach (West Germany).
IONSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, JANUARY 1970 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE-131, JANUAR 1970]
Jan. 1970 44 p In GERMAN and ENGLISH
(Rept-283-F) Avail: CFSTI

Daily summaries are presented for vertical echo sounding of the upper atmosphere during January 1970. The data include charts of median values for the E and F regions, MUF(3000)F2, M(3000)F2, h'F2, hpF2, foF1, MUF(3000)f1, M(3000)F1, h'F, foE, foE2, h'E, foEs, fbEs, h'Es, Type Es, foT, and fmin. R.B.

N70-34280 National Lending Library for Science and Technology, Boston Spa (England).
MEAN AND EXTREME OZONE CONCENTRATIONS IN THE ATMOSPHERE
A. S. Britaev et al 24 Jun. 1970 19 p refs Transl. into ENGLISH from Tr. Cent. Aerol. Observ. (USSR), no. 83, 1969 p 3–19
(NLL-M-9227-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .2 NLL photocopy coupons

The distribution and variation of the density of atmospheric ozone is analyzed to study processes in the troposphere and stratosphere. Analyses of the ozone sounding profiles show that the total ozone content below 30 km decreases from polar to tropical latitudes. The vertical distribution of ozone is discussed with the seasonal influences. It is concluded that variations in the ozone field are closely related to long waves in the zonal circulation of the atmosphere. F.O.S.

N70-34281# Naval Oceanographic Office, Washington, D.C.
OUR KNOWLEDGE OF ICE REGIME OF THE KURISCHES HAFF [K VOPROSU OB IZUCHENNOSTI LEDOVOGO REZHIMA KURSHSKOGO ZALIVA]
T. V. Pustovalova 1970 14 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Observ. (USSR), no. 1, 1964 p 82–187
(AD-705819; NOO-Trans-476) Avail: CFSTI CSCL 8/10

Data gathered by observation stations since 1900 disclose the nature and variations of ice condition in the Kurisches Haff. As a rule, the ice is thicker in the wider central and southern parts of the gulf than in the narrowing northern part of gulf which is more subjected to the influence of the sea. The mean duration of ice is 80 days, minimum 30 days, maximum 3.5-4 months. The ice usually appears at the beginning of December, the mean date being 3 December, the early date 31 October, the late date 21 January. The ice disappears in March, the mean date being 20 March, the early date 6 February, the late date 18 April. Author (TAB)

N70-34284# Naval Oceanographic Office, Washington, D.C.
THE FACTORS THAT FORM THE THERMAL STRATIFICATION OF ANTARCTIC WATERS [O FAKTORAKH, FORMIRUYUSHCHIKH TERMICHESKUYU STRATIFIKATSIYU ANTARKTICHESKIKH VOD]
Yu A. Ivanov 1970 15 p refs Transl. into ENGLISH from Okeanologiya (USSR), v. 1, no. 6, 1961 p 992–996
(AD-705817; NOO-Trans-280) Avail: CFSTI CSCL 8/3

In the investigation of factors that form the thermal stratification of Antarctic waters, the author examines not only local processes but also those processes that occur outside the Antarctic region. Therefore, the vertical and horizontal distribution of water temperature, salinity, oxygen and other phenomena over wide areas is examined in conjunction with water movement and turbulence. The relationship and variation of these parameters are defined by mathematical formulas. The results are compared with heat budget equations and their degree of accuracy is appraised. Author (TAB)

N70-34319*# Ballistic Research Labs., Aberdeen Proving Ground, Md. Signature and Propagation Lab.
D-REGION ELECTRON DENSITY MEASUREMENTS DURING THE SOLAR ECLIPSE OF 12 NOVEMBER 1966
Harold T. Lootens and William A. Dean Jan. 1970 38 p refs Sponsored by NASA
(NASA-CR-110685; AD-701868; BRL-R-1464) Avail: CFSTI CSCL 04A

Under the sponsorship of the Defense Atomic Support Agency (DASA), and in cooperation with the Brazilian Space Commission (CNAE), the National Aeronautics and Space Administration (NASA) and Sandia Corporation, the Ballistic Research Laboratories (BRL) instrumented and launched five Nike-Javelin III rockets from the southeastern coast of Brazil before and during the total solar eclipse of 12 November 1966. Each payload carried a nose-tip Langmuir probe for electron density and temperature measurements, two receivers to provide data for a partial reflection experiment and for differential absorption measurements, and a parachute-borne blunt probe (ejected from the payload at apogee) for positive and negative charge conductivity measurements. Electron densities derived from the Langmuir probe are presented as a function of time and altitude during the eclipse. Results from the other experiments have already been reported and are referenced. Author (TAB)

N70-34320# Texas A&M Univ., College Station. Dept. of Oceanography.
SOUND VELOCITIES IN GULF OF MEXICO SEDIMENTS AS RELATED TO PHYSICAL PROPERTIES AND SIMULATED OVERBURDEN PRESSURES
Paul John Cernock May 1970 125 p refs
(Contract N00014-68-A-0308-0002)
(AD-705611; Rept-70-5-T) Avail: CFSTI CSCL 20/1

Specific objectives of this investigation were: To measure the velocity of compressional waves (hereinafter called sound velocity or velocity): (a) in consolidated and unconsolidated sediments cored from the Gulf of Mexico; To investigate the physical and mechanical properties of these sediments; To examine the possibility of utilizing sound velocities to predict the physical and mechanical properties of these sediments; and To formulate porosity, bulk density, and velocity versus depth relationships for unconsolidated sediments in the Gulf of Mexico. Author (TAB)

N70-34342*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECOVERY OF ZONAL GEOPOTENTIAL INFORMATION FROM GODDARD MINITRACK DATA
Carl A. Wagner, Barbara H. Putney, and Elise R. Fisher May 1970 29 p refs
(NASA-TM-X-69981; X-552-70-160) Avail: CFSTI CSCL 08N

The first determination of accurate zonal gravity harmonics from minitrack data since 1959 was made. Results are preliminary but promising for an expanded solution using more data on more satellites to recover higher degree zonal terms. The solution was made by the Rapid Orbit Analysis and Determination Program which performs all orbit computations numerically by integrating the LaGrange planetary equations, retaining only disturbing terms which give secular or long period effects. The entire numerical process involving 3 iterations of least squares solutions to convergence requires about 6 minutes on an IBM 360/91 computer. Author

N70-34544 National Lending Library for Science and Technology, Boston Spa (England).
THE STRUCTURE OF THE EARTH'S CRUST IN THE REGION OF MOUNTAINOUS CRIMEA [PRO BUDOVU ZEMNOI KORI V RAIONI GIRSKOGO KRIMU]
V. B. Sollogub et al May 1970 8 p refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr. RSR (Ukrania SSR), no. 9, 1966 p 1194–1197
(NLL-RTS-5550) Avail: Natl. Lending Library, Boston Spa Engl.: 14s or 2 NLL photocopy coupons

Information on the hypogene structure of the earth's crust in the Mountainous Crimea was found by seismic and gravimetric analysis. Low intensity waves were recorded estimating the thickness of the earth's crust below Mountainous Crimea. It was found that the region is bounded by deep fractures in the north and south. The surfaces of the granitic and basaltic layers were found to be raised, causing the presence of positive gravitational anomalies. S.S.

N70-34574# Massachusetts Inst. of Tech., Cambridge. Dept of Meteorology.
TOPSIDE IONOSPHERE ELECTRON DENSITY

CONCENTRATION: OBSERVATION AND THEORY
Mao-Fou Wu (Ph.D. Thesis) 27 Oct. 1969 207 p refs
(Contract AT(30-1)-2241; Grant NSF GA-1310X)
(MIT-2241-54; Rept-23) Avail: CFSTI

Anomalies have long been studied from ground-based ionosonde data. In this study, three years of Alouette I satellite data on the topside ionosphere, between the F2 peak and 1000 km, are analyzed. The equatorial anomaly and the seasonal anomaly appear clearly in the diagrams, which show similar features to those observations from the bottomside ionosphere. In addition, an electron trough in the nighttime ionosphere is verified as a permanent feature. NSA

N70-34619# California Univ., Berkeley. Earthquake Engineering Research Center.
RESPONSE OF NON-UNIFORM SOIL DEPOSITS TO TRAVELLING SEISMAC WAVES
Houshang Dezfulian and H. Bolton Seed Sep. 1969 31 p refs
(Grant DI-14-08-0001-G-10)
(PB-191023; EERC-69-13) Avail: CFSTI CSCL 13B

Records of ground motions in recent earthquakes have provided convincing evidence of the important effects of local soil conditions on the amplitude and frequency characteristics of ground surface motions. Marked variations in surface motions may occur over relatively short distances due to variations either in depth or character of the underlying soil deposits. Such variations are particularly apt to occur in area adjacent to sloping rock surfaces such as that shown and methods of evaluating these variations by determining the response of the soil deposit to motions developed in the underlying rock have been presented. Author (USGRDR)

N70-34621# Texas A&M Univ., College Station. Coastal and Ocean Engineering Div.
NUMERICAL CALCULATION OF WAVE REFRACTION BY DIGITAL COMPUTER
Terry E. Orr and John B. Herbich Dec. 1969 86 p refs *Its* Sea Grant Publ. No. 209
(Grant NSF GH-29)
(PB-190057; COE-114) Avail: CFSTI CSCL 08C

Recent developments in methods for analysis of offshore structures warrant refining the calculation of wave forces that will act on the structures. Wave height is one of the prime criteria required to obtain an accurate estimate of these forces; therefore, it is imperative that the engineer be able to predict the wave height as closely as possible. In shoaling waters refraction affects the wave height significantly and can either increase it or decrease it. LePetit of the laboratoire National d'Hydraulique in France has proposed a method for calculating wave refraction using numerical methods. In the present thesis a computer program was developed based on LePetit's method and a number of refraction patterns were obtained for waves passing over a region of complex hydrography. Author (USGRDR)

N70-34773# Joint Publications Research Service, Washington, D.C.
INTERNATIONAL RELATIONS OF SOVIET GEODESISTS AND CARTOGRAPHERS
N. N. Spasskiy 17 Jul. 1970 12 p Transl. into ENGLISH from Geod. Ez. i Kartograf. (Moscow), May 1970 p 62 - 69
(JPRS-50964) Avail: CFSTI

International cooperation is advocated for geodetic services in compiling complex thematic maps and atlases of the whole territory of the earth. Emphasis is placed on problems of cartography; existing cooperative participation with Soviet bloc countries and friendly governments is briefly outlined. G.G.

N70-34781*# Scientific Translation Service, Santa Barbara, Calif.
ESSAY OF AN OCEAN-MORPHOLOGICAL INTERPRETATION OF SATELLITE PICTURES [VERSUCH EINER MEERESMORPHOLOGISCHEN DEUTUNG VON SATELLITEN-LUFTBILDERN]
E. Haase et al Washington NASA Aug 1970 29 p refs Transl. into ENGLISH from Deut. Hydrograph. Z. (Hamburg), v 22, no. 5, 1969 p 193 - 204
(Contract NASw-2035)
(NASA-TT-F-13159) Avail: CFSTI CSCL 08J

For some time, satellite pictures have been used to evaluate land masses. It has been generally assumed that in such pictures the oceans are shown by a uniform and undifferentiated black color. However, it was found that on some of these photos of the oceans, greyish shades were clearly visible. This led to the assumption that one is confronted here primarily, or at least secondarily, by a correspondence with submarine structures and, therefore, satellite photos could perhaps also be evaluated in an oceanmorphological way. In order to test such a possibility, 27 satellite photos out of a collection of pictures were compared with the respective sea-charts and other data. In some instances, amazing correspondence of certain greyish hues with the known substratal forms became visible. So far, only vague statements can be made regarding other regions. At this point, it cannot as yet be decided whether and how extensive a primary or secondary connection exists. The necessary technical data for the evaluation of such satellite photos, concerning the receiving and transmitting procedures is summarized. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-33465# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Group.
ELECTRONIC SYSTEM FOR PULSE RISE TIME DISCRIMINATION WITH A PROTON RECOIL PROPORTIONAL COUNTER
J. R. Taylor Oct. 1969 29 p refs
(AEEW-R-651) Avail: AEC Depository Libraries; HMSO 5s 6d; BIS$1.10

An electronic pulse counting system in current use on the Zero Energy Fast Reactor ZEBRA for neutron spectra analysis from 3 keV to 1 MeV is described. The system uses a proton recoil proportional counter as detector and incorporates neutron-gamma separation by rise time discrimination. The collected data are stored in a Ferranti Argus 500 computer, for which a three-dimensional display is provided. Author (NSA)

N70-33484# Politecnico di Torino (Italy). Ist. di Fisica Tecnica.
AN AUTOMATIC PLATE APPARATUS FOR MEASUREMENTS OF THERMAL CONDUCTIVITY OF INSULATING MATERIALS AT HIGH TEMPERATURES
V. Ferro and A. Sacchi Sep. 1968 30 p refs Presented at 8th Conf. on Thermal Conductivity, West Lafayette, Ind., 7-10 Oct. 1968
(PT-IFT-299/b) Avail: CFSTI

An apparatus is described for measuring the thermal conductivity of insulating materials used up to 1000 C. It is based on the method of the square-plate heater (250 mm side) with a guard-ring (500 mm side), placed between two identical layers of the material under test; the whole system is enclosed between two water refrigerated plane boxes. The Ni-Cr heating element, with alumina insulation and stainless-steel 310 protection plates, is divided into two zones; a central 250 mm side measuring zone and

a peripherical guard zone, which consists of four independent parts. There are two thermocouples for measuring and controlling the temperature of the central zone, and twenty-four differential thermocouples connected in series over the guard zone, so as to keep the two zones at the same temperature. All these Chromel-Alumel thermocouples, 0.5 mm diameter, carefully calibrated, are placed in grooves (2.5 mm side) and insulated by means of alumine covers. Five, three-action automatic controllers, with their magnetic amplifiers, provide for the equlization of the temperatures over the central and peripheric zones; whereas a converter measures the power given to the central zone. Experiments were done with this apparatus on rock wool, glass wool, asbestos, kieselguhr, refractories. The results were correlated and plotted on temperature versus specific apparent density diagrams. Author

N70-33487# Bunker-Ramo Corp., Canoga Park, Calif. Defense Systems Div.

A PRELIMINARY COMPARISON OF LASERS WITH PHOTOGRAPHY FOR FINDING TACTICAL TARGETS Final Report

William S. Myers and Herschel C. Self Wright-Patterson AFB, Ohio AMRL Jan. 1970 33 p ref

(Contract F33615-68-C-1593)

(AD-705652; AMRL-TR-69-115) Avail: CFSTI CSCL 17/8

Six photographic transparencies of a simulated jungle area containing a variety of model tactical targets including trucks, aircraft, artillery, etc., were tested on their relative value for near-real-time reconnaissance. Two of the transparencies, high resolution black-and-white and color photography, are representative of a good daylight tactical reconnaissance capability. The remaining four transparencies were made with experimental multispectral laser night sensor systems. Each transparency was projected onto a translucent screen (9.7 inches high by 18 inches wide) for a period of two minutes and the test subject asked to locate the tactical targets. There were eight subjects per transparency with a total of 48 subjects tested. For the entire two minute viewing time the number of targets detected and the accuracy of responses were not significantly different among the six transparencies. On the average, targets were found more rapidly on the black-and-white photographic transparency than on the color photographic transparency but this slight advantage did not hold up for the groups with the transparencies made with the night sensors. For the first 30 seconds viewing time the black-and-white photo group was superior on number of target detections and detection time, with some of the night sensor transparencies equal to the color photography on these performance measures. All six groups were essentially equal in accuracy during the first 30 seconds of exposure to the transparencies. Author (TAB)

N70-33495# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimentalnoi Fiziki.

ITEP 2 METER LIQUID HYDROGEN BUBBLE CHAMBER

Yu. D. Aleshin, G. A. Arutyunyantz, V. S. Verebryusov, G. B. Gerber, L. L. Gracheva et al 1969 24 p refs In RUSSIAN; ENGLISH summary

(ITEF-689) Avail: AEC Depository Libraries

The design and operation characteristics of the 205 × 60 × 41 cm liquid hydrogen bubble chamber are given. The expansion system consists of a 30-cm-diameter piston and two three-step pneumatic valves. The thermostabilization system keeps the temperature constant within the chamber volume up to 0.1 K. The illumination is performed with three flash tubes or lasers and a retrodirective cosethenger system. Three f = 200 mm lenses and unperforated 80 mm film are used. The magnetic field equals 21.7 kilogauss at 3.8 MW. The chamber can be exposed to the beams of 3 to 5.2 GeV/c secondary particles from the ITEP proton synchrotron. Tracks were obtained at 28.6 K, 6.3 absolute atmospheres and 2.2 atm pressure drop. Author (NSA)

N70-33511# Central Electricity Generating Board, Berkeley (England). Research and Development Dept.

SMALL AREA CONTAMINATION MONITOR CONCEPT USING A SILICON p-n JUNCTION DETECTOR

W. N. Walker Jan. 1970 10 p refs

(RD/B/N-1576) Avail: AEC Depository Libraries

A method of designing a small area contamination monitor or surface dose hot spot monitor is described. Such an instrument would use a silicon junction detector in a novel circuit which provides a wide range of operation and avoids leakage current problems in the detector. The specification of a suggested prototype instrument is given. Author (NSA)

N70-33518# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Biology and Health Physics Div.

THE USE OF MINIATURE ELECTRONICS IN RADIATION PROTECTION

A. R. Jones Mar. 1970 26 p refs Presented at 2d Intern. Congr. of the Intern. Radiation Protect. Assoc., Brighton, Engl., 3-8 May 1970

(AECL-3566) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River; $1.00

Examples of techniques in miniature electronics which are now being used in instrument design are described. The design and performance of three instruments based on these techniques are also summarized: A very high range gamma survey meter using a silicon junction detector as a solid-state ion chamber is discussed. The detector is used as a photo-voltaic device and the current generated is amplified by a miniature low power dc amplifier. A small alpha monitor using a silicon surface barrier detector and a monolithic pulse amplifier to amplify the pulses produced by the alpha particles is described. A gamma survey meter is evaluated using an amplifying radiation detector to measure dose rates from 1 mrad/h to 1000 rad/h. The output is displayed in digital form by light emitting diodes and the digital circuits use field-effect transistors with very small power needs. Author

N70-33527# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.

DOUBLE IRON FREE COINCIDENCE ORANGE SPECTROMETER

Yu. N. Rakivnenko, I. A. Romanii, E. A. Shakun, A. P. Klyucharev, V. M. Nakonechnyi et al 1969 28 p refs In RUSSIAN

(KHFTI-69-5) Avail: AEC Depository Libraries

A double iron-free orange spectrometer intended for the study of the decay of short-lived activities is described. The spectrometer operates under a beam of charged particles. Each of the spectrometer lenses contains 100 loops made from a copper profiled tube. The shape of the working sgements of the loops was calculated so that it ensured focusing of 2 MeV electrons at a maximum line current of 600 amp. The design of the spectrometer makes it possible to carry out several types of experiments. Replacement of targets or sources is made through vacuum chambers without disturbing the vacuum in the device. The operation of the beta-spectrometer was checked with Cs-137 source of diameter 10 mm. The parameters of the device as determined experimentally with this source are the following: transmission per lens 16% from 4 pion, resolution 1%. The spectrometer was placed under an accelerator beam of multicharged ions. The transportation and focusing system of the beam makes it possible to introduce into the target 96% of the extracted beam of ions for a diameter of the focusing spot of 10 mm. Author (NSA)

N70-33554 British Broadcasting Corp., Kingswood (England). Research Dept.

IMPROVEMENTS TO COLOUR FILM PROJECTION BY MODIFYING THE SPECTRUM OF THE ILLUMINATION

J. O. Drewery 1970 16 p refs

(Rept-1970/19; PH-60) Avail: Issuing Activity

A theoretical investigation was carried out into the possibility of improving the quality of reproduction of color film by the use of a modified form of projection illuminant. A simplified treatment was followed which neglected the effects of masking in the photographic process and summed an overall gamma of unity for the photographic process. Significant improvements in the chromaticity of displayed colors are obtained by the use of an illuminant which reduces the effect of cross coupling between the film dyes. Depending on the particular color, however, the luminance may be either slightly improved or moderately impaired by the use of such an illuminant. A small but significant improvement in color rendering is achieved. Author

N70-33587# Technische Hogeschool, Delft (Netherlands).
LOCAL PILE OSCILLATOR AS A DEVICE FOR MEASURING TEMPERATURE DEPENDENCE IN EPITHERMAL NEUTRON ABSORPTION
Arij Leendert Dekker (Ph.D. Thesis) 1969 130 p refs
(NP-18138) Avail: AEC Depository Libraries

Use of the pile oscillator in research reactors for measuring temperature dependence of epithermal neutron absorption is discussed. Detailed descriptions of oscillator components are given; data collection and reduction methods are described. Methods for calibration of the oscillator are discussed. Analytical techniques for computing resonance integrals and Doppler coefficients are described. Computed and measured values are compared. NSA

N70-33601# Naval Research Lab., Washington, D.C. Nuclear Physics Div.
A PROPORTIONAL COUNTER FOR THERMALLY STIMULATED EXOELECTRONS
F. H. Attix *In its* Rept. of NRL Progr. May 1970 p 1–14 refs (See N70-33600 18-34)
Avail: CFSTI

The design and operational parameters are given for a methane-flow proportional counter suitable for the detection of thermally stimulated exoelectrons. It was found that the resulting pulse-height distributions differ among the four count-rate glow peaks in beta irradiated LiF. Higher temperature glow peaks tend to produce larger pulses. Possible explanations are examined. Author

N70-33625# Naval Postgraduate School, Monterey, Calif.
A DIGITAL TACHOMETER/ACCELEROMETER
John Hone Bartol, Jr. (M.S. Thesis) Dec. 1969 47 p refs
(AD-706023) Avail: CFSTI CSCL 14/2

Analog methods for measuring rotational shaft velocity and acceleration are well developed, yet present many drawbacks in practical use. A device is proposed to digitally compute estimates of the instantaneous velocity and acceleration of a shaft. The method of attack used in arriving at a final design proceeds from development of signal generating equipment through velocity- and acceleration-processing circuitry. Computer simulation is used to optimize the electronic circuitry to achieve the best accuracy. Author (TAB)

N70-33629# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
A TIME-OF-FLIGHT SPECTROMETER FOR ION COLLISION STUDIES
R. L. Woolley, A. G. Warner, and D. H. Poole Jan. 1970 28 p refs
(RD/B/N-1320) Avail: AEC Depository Libraries

A description is given of equipment built to measure scattering cross sections of atom-atom collision processes in the energy range 5 to 100 keV, and the development of displacement cascades in solids, with special reference to damage cascades in reactor materials. Author (NSA)

N70-33632# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.
ASSESSMENT OF PERSONAL FAST NEUTRON DOSES USING AN AUTOMATIC PROTON TRACK COUNTER
J. A. Douglas Dec. 1969 25 p refs
(AERE-R-6220) Avail: CFSTI

The present method of visually counting tracks in nuclear emulsion is slow and tedious and results in poor statistics. The use of an automatic counter should eliminate subjective errors and be faster, thus giving greater statistical accuracy. For this reason the basic performance of the automatic counter for recoil proton tracks and its performance as a fast neutron dosemeter reader were assessed using nuclear emulsions that were exposed to monoenergetic protons, neutrons and gamma radiations. It was shown that the minimum length of track recognizable is 5 micrometers. Other measurements made included track counting efficiency, minimum detectable dose, apparent background dose, effect of track orientation, and the effect of additional gamma dose. The machine performance is better than that obtained with visual counting for neutron badges which were exposed to neutrons of energy > 1.5 MeV but not for low energy neutrons such as those leaking from a reactor. Author (NSA)

N70-33675# Boeing Scientific Research Labs., Seattle, Wash.
STAGNATION TEMPERATURE MEASUREMENT AT HIGH MACH NUMBER USING VERY SMALL PROBES
R. P. Shreeve and D. W. Peecher Jan. 1970 28 p refs
(AD-704962; D1-82-0945) Avail: CFSTI CSCL 14/2

A series of tests of simple thermocouple probes of different sizes was conducted in a Mach 6 flow at a stagnation pressure of 800 psi and stagnation temperature of 715 plus or minus 10F. The results support the argument introduced that as the physical scales are reduced, the temperature recovery factor tends to unity. In tests of the smallest probe (which uses 0.0005 in wires in a 0.032 in diameter insulator) at angles of attack up to 20 deg, stagnation pressures from 640 to 910 psi and stagnation temperatures from 685F to 920F, the recovery factor was within 1.5% of unity. The implication of these results is that the measurement of stagnation temperature in a high Mach number flow does not require a complex probe but rather, a small one. There is always a wire size for a given probe size which will measure stagnation temperature in a given flow to within 1%. Author (TAB)

N70-33705# Joint Publications Research Service, Washington, D.C.
GYROCOMPASS FOR MAGNETOMETRIC OPERATIONS IN THE SEA
V. I. Sigachev *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 1–8 refs (See N70-33704 18-13)
Avail: CFSTI

An existing model of a marine gyrocompass was redesigned for making magnetic measurements in the sea. The sensitive element of the device remained unchanged, while the follow-up system was excluded. Performance tests of the device in combination with magnetometric equipment indicate that it is stable in operation when towed at depths of 20 to 40 meters and speeds up to 8 knots. R.B.

N70-33707# Joint Publications Research Service, Washington, D.C.
ERRORS OF THE FERROSONDE COMPONENT OF A MAGNETOMETER FOR SMALL DEVIATION ANGLES OF THE Z AND H SENSORS AND COMPENSATION FOR THEM
V. N. Karnaushenko *In its* Electromagnetic Phenomena in the Sea 27 Mar. 1970 p 21–30 ref (See N70-33704 18-13)
Avail: CFSTI

The errors occurring during deviation of the vertical component (z) sensor of a ferrosonde magnetometer from the axis of the true

vertical is analyzed as a function of the magnitude and position of the total geomagnetic field vector with respect to the shifted Z sensor. The errors occurring during an arbitrary small deviation of the plane of the position of the horizontal(H) sensor from the plane of the true horizon are also considered. Calculating formulas are derived to compensate for errors caused by deviation of both the Z and H sensors. R.B.

N70-33718# Air Force Cambridge Research Labs., Bedford, Mass.
ON THE INVESTIGATION OF INSTRUMENTAL ERRORS OF UNIVERSAL AND TRANSIT INSTRUMENTS BY MEANS OF AUTOCOLLIMATION
Reiner Schwebel Feb. 1970 202 p refs Transl. into ENGLISH from a Germ. Dissertation
(AD-705537; AFCRL-70-0097; AFCRL-TRANS-49) Avail: CFSTI CSCL 8/5

Geodetic astronomy depends to a certain degree on the precision of available instruments. This investigation covers the instrument errors that effect the determination of a horizontal direction and the effect of these errors on position accuracy determination by horizontal angle measurements and vertical transits. The following errors were investigated: (1) axis errors; that is, horizontal, tilt and target axis (2) instrument errors; that is, divided circle, micrometer, and level bubble and heat deflection of the telescope. These errors seldom exceed + 1 minute. Three common first order instruments, the Wild T-4, Kern DKM-3, and the Askania AP70 were investigated. The direct investigation of the instrumental errors was conducted utilizing very precise auto-collimation methods, and statitical methods for defining the type and magnitude of the errors. Author (TAB)

N70-33757# Sandia Corp., Albuquerque, N.Mex. Special Test Equipment Design Div.
DEVELOPMENT OF A LABORATORY LEAK TESTER
Everett G. Hayes Mar. 1970 18 p Supersedes <SC-DR-69-367< (SC-DR-69-367A) Avail: CFSTI

The design, characteristics, and development history of a portable laboratory leak tester are described. The unit is capable of checking leaks in valves, fittings, gages, etc. Author

N70-33820# Union Carbide Corp., Oak Ridge, Tenn. U-12 Plant.
ERROR DUE TO DEFLECTION IN A TWO-AXIS MEASURING MACHINE
J. R. Johnson, Jr. 24 Apr. 1970 18 p
(Contract W-7405-eng-26)
(Y-1711) Avail: CFSTI

Error due to the deflection caused by probe-spring forces in a two-axis measuring machine has been derived. Tests were run to obtain data for the determination of this error, and the results of a computer program were used to calculate errors for different amounts of probe displacement with part contact at various angles. Author

N70-33913# Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.
SMOOTHED THERMOCOUPLE TABLES OF EXTENDED SIGNIFICANCE, VOLUME 1
R. K. Adams and R. L. Simpson Apr. 1970 72 p
(Contract W-7405-eng-26)
(ORNL-3649-Vol-1) Avail: CFSTI

Although thermocouple calibration tables of emf(mv abs) vs temperature usually have enough significant digits for many purposes, the rounding errors often limit the use of these tables (and hence thermocouples) for precise measurements of temperature related effects such as thermal conductivity or specific heat. Fourteen calibration tables for common thermocouples and for cyrogenic thermocouples were smoothed. A general discussion of data smoothing techniques and a description of the procedures by which the smoothed tables were prepared are given. Author

N70-33920*# Perkin-Elmer Corp., Norwalk, Conn.
DEVELOPMENT OF AN ACTIVE OPTICS CONCEPT USING A THIN DEFORMABLE MIRROR
Hugh J. Robertson Washington NASA Aug. 1970 116 p refs
(Contract NAS1-7103)
(NASA-CR-1593) Avail: CFSTI CSCL 20F

The design, construction and test results are described for an active control experiment with a 30-inch diameter thin flexible mirror whose surface was aligned by straining the mirror with an array of actuators distributed across its back. Sixty-one points of force application were used to provide a test of the servo response characteristics of a high order, multi-loop control system with the strong interactions that would be encountered in a very large flexible primary mirror. The initial figure error of the 30-inch mirror, which was greater than 1/2 wavelengths rms, was decreased by active alignment to less than 1/50 wavelength rms, which betters the requirement for diffraction limited performance. Author

N70-33950# Sandia Corp., Albuquerque, N. M.
STRAIN GAGE AND ACCELEROMETER TESTING
F. C. Dain Jan. 1970 6 p Sponsored by AEC
(SC-DR-69-843) Avail: CFSTI

A simple, inexpensive method of actuating tuning forks used in the dynamic testing of strain gages and accelerometers is presented. This technique is particularly useful for pretesting of the instrumented tuning forks. Author (NSA)

N70-33978# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPRAISAL OF THE POSSIBILITY OF OPERATION OF AN AZIMUTH-MOUNTED OPTICAL TELESCOPE WITH AN ELECTRONIC DIGITAL CONTROL SYSTEM
E. M. Neplokhov 31 Mar. 1970 18 p refs Transl. into ENGLISH from the Russian
(AD-705753; FTD-MT-24-49-70) Avail: CFSTI CSCL 17/8

The tracking of a celestial body can be achieved by the joint operation of three systems: (1) a control digital computer; (2) a photoelectric automatic correction; (3) a field rotation compensation. Astronomic, instrumental, and computer errors are analyzed for a system operating without the photoelectric automatic correction. It is found that the digital control system can ensure homing on (aiming at) a target and also tracking for a limited time; the maximum error of homing and tracking occurs at t equals 24 hrs and delta equals 43 degrees (near-zenith zone); homing and tracking errors and their rates of variation decrease as the zenith distance increases; an error accumulation due to digital control produces a blurring of the image; the tracking error builds up slowly which permits operation without the photoelectric automatic correction for a limited time. TAB

N70-34024*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
TECHNIQUES APPLIED IN COMPILING THE TRANQUILLITY BASE SURFACE AND EXPERIMENT POSITIONS MAP
W. H. Arant 16 Dec. 1969 24 p refs
(Contract NAS9-5191; Proj. Apollo)
(NASA-CR-108564; TWP-69-032) Avail: CFSTI CSCL 14E

Techniques applied in compiling the Tranquility Base Surface and Experiments Positions map are presented with the mathematical formulas used in recapturing the geometry of the photography. The method used in establishing relative positions, and the construction of grids for the photographs are described. It is concluded that this type of photography and these techniques can be used for positioning features on a map with reasonable accuracy, to provide a preliminary working map, useful for positioning experiments and site documentation. F.O.S.

N70-34025# Pennsylvania State Univ., University Park. Materials Research Lab.
COMPUTER PROCESSING OF SEM IMAGES BY CONTOUR ANALYSES
William L. Matson, Herbert A. Mc Kinstry, Gerald G. Johnson, Jr., Eugene W. White, and Ralph E. Mc Millan 9 Jan. 1970 26 p refs Presented at Symp. on Computational Photogrammetry, Washington, D.C., 1970
(Contract N00014-67-A-0385-0007)
(AD-701782; TR-2) Avail: CFSTI CSCL 20/6

Techniques involving the computer processing of scanning electron microscope (SEM) images using a contouring approach have been developed. For each picture from one to six different SEM signals are converted from analog to digital form and recorded on magnetic tape for subsequent computer analysis. A program finds and analyzes coordinate arrays representing the reconstructed computer picture. Least squares fitting of the contour arrays to ellipses provides measurements of the aspect ratios and orientations of the picture fields. Line integration techniques produce areas and perimeters. Computer plotting enables both the visual comparison of the reconstructed picture with a photograph of the image on the cathode ray type of the SEM and an estimate of the accuracy of the ellipse fits. Author (TAB)

N70-34097# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHOTOELECTRIC EXPOSURE METERS METHODS OF TESTING
26 Mar. 1970 17 p Transl. into ENGLISH from Gos. Standart Soyuza SSR (Moscow), GOST 13831-68, 1968 p 1-9
(AD-705231; FTD-MT-24-01-70) Avail: CFSTI CSCL 14/5

All Union Government Standards are listed which are applicable to photoelectric exposure meters. The standards establish methods for: checking the calibration of exposure meters for illuminance and brightness; determination of basic error in exposure meters; checking the moving parts of exposure meters; checking the opaqueness of the housings; determination of temperature error; determination of fatigue; determination of coefficient and angles of perception; determination of stability of exposure meters to mechanical influences; determination of stability to climatic influences. Author (TAB)

N70-34156* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENTHALPY AND STAGNATION TEMPERATURE DETERMINATION OF A HIGH TEMPERATURE LAMINAR FLOW GAS STREAM Patent
Lloyd N. Krause, George E. Glawe, and Robert C. Johnson, inventors (to NASA) Issued 7 Sep. 1965 (filed 12 Jun. 1962) 6 p Cl. 73-15
(NASA-Case-XLE-00266; US-Patent-3,204,447;
US-Patent-Appl-SN-202024) Avail: US Patent Office CSCL 14B

A method is described for measuring the steady-state one-dimensional conductive heat flow through a thermally insulated cylindrical plug extending from the stagnation point on a spherical surface. The conductive heat flow and the thermal conductivity of the plug are used to calculate the energy of the gas stream by correlating these values with other known parameters of the gas stream. The method is applied to simulation of atmospheric reentry conditions. R.B.

N70-34158* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LIGHT SENSITIVE DIGITAL ASPECT SENSOR Patent
James S. Albus, inventor (to NASA) Issued 7 Sep. 1965 (filed 10 Mar. 1961) 12 p Cl. 250-203
(NASA-Case-XGS-00359; US-Patent-3,205,361;
US-Patent-Appl-SN-94952) Avail: US Patent Office CSCL 17/H

A light aspect sensing device is described which produces a direct binary digital signal corresponding to the direction of a light source relative to the sensor. The device can be mounted on an earth satellite or space probe to provide elevation and azimuth angles of the sun vector relative to the payload coordinate system. The digital output is suitable for transmission by a pulse code modulated telemetry system. R.B.

N70-34161* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SURFACE ROUGHNESS DETECTOR Patent
John B. Hall, Jr., James C. Brady, and Staten B. Price, inventors (to NASA) Issued 28 Sep. 1965 (filed 28 Sep. 1962) 9 p Cl. 73-105
(NASA-Case-XLA-00203; US-Patent-3,208,272;
US-Patent-Appl-SN-227882) Avail: US Patent Office CSCL 14B

A roughness detector employing an electronic circuit to detect and record any surface pattern of irregularities of a particular specimen is described. A graphic representation of the surface is acquired by a motor-driven sensitive feeler adapted for linear movement at a uniform rate over the surface area to be investigated. An electric circuit connected to the feeler member produces detectable and recordable signals in response to any vertical deviation of the feeler. R.B.

N70-34166*# Raytheon Co., Sudbury, Mass.
SPACE GEODESY ALTIMETRY: PULSE COMPRESSION RADAR STUDY
Washington NASA Jul. 1970 164 p refs
(Contract NASw-1709)
(NASA-CR-1605; R69-4346) Avail: CFSTI CSCL 17I

A study was conducted to establish the applicability of pulse compression to satellite altimetry. Parametric trade offs were made and experimental results presented. The study concludes that if 10 cms measurement accuracy is to be achieved a pulse compression system can achieve it with less size, weight and power than can a system that relies solely on a short pulse for its accuracy. Author

N70-34194# Naval Postgraduate School, Monterey, Calif.
MARGINAL OSCILLATOR FOR A MODIFIED FREE PRECESSION MAGNETOMETER
Jerome William Offenberg (M.S. Thesis) Jun. 1969 42 p refs
(AD-705083) Avail: CFSTI CSCL 14/2

The primary interest concerns the use of a magnetometer for mine detection, anti-submarine warfare, salvaging and other related naval operations. The original concept of a modified free precession magnetometer using the Overhauser Effect was formulated by A. Abragam. The objective of this thesis was to develop an improved marginal oscillator for the magnetometer. Author (TAB)

N70-34272# Utah Univ., Salt Lake City. Upper Air Research Lab.
ROCKET INSTRUMENTATION FOR PCA MEASUREMENTS: BLACK BRANT 17.767
David A. Burt and Glenn D. Alfred Mar. 1970 83 p refs
(Contract F19628-67-C-0275)
(AD-705599; UU-70-1; AFCRL-70-0196; SR-4) Avail: CFSTI CSCL 19/7

A Black Brant rocket, instrumented to measure ionospheric parameters was launched from Churchill Research Range, Manitoba, Canada, in November 1968, during a Polar Cap Absorption event. The purpose of the flight was to investigate input proton fluxes and corresponding effects upon the ionospheric D-region. The payload of the rocket contained instruments to measure input proton fluxes, electron density and temperature, positive ion density, X-rays, Lyman-alpha radiation, and atmospheric optical emissions. Experimental procedures and instrumentation are described. Author (TAB)

N70-34282# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PROBLEMS OF THE STATE AND DEVELOPMENT OF HIGH-SPEED STEREOSCOPIC FILMING
A. S. Dubovik et al. 9 Mar. 1970 18 p refs Transl. into ENGLISH from Zh. Nauch. Prikl. Fotogr. Kinematogr. (USSR), v. 11, no. 1, 1966 p 33-38
(AD-705795; FTD-MT-24-460-69) Avail: CFSTI CSCL 14/5

A method was devised of high-speed stereoscopic filming using two AKS-2 cameras mounted on a shaft, providing a base up to 2 m. These, in turn, were mounted on a special support attached to a stand. Frame frequency was 100 frames per second during an exposure time of 1/1000 of a second. A method of 'pulse frequencies', for synchronization is reviewed. For higher-frequency filming, the authors suggest a pair of SFR-L cameras synchronized using an automatic tracking system. The authors also describe a stereo filming technique by splitting the frame, and another without doing so, using the principle of optical comutation of the image.
TAB

N70-34287# Naval Oceanographic Office, Washington, D.C.
THE MEASUREMENT OF OBJECTS IN OPEN SEA WITH THE AID OF PHOTOGRAPHY [IZMERENIYE PREDMETOV V OTKRYTOM MORE S POMOSHCHYU FOTOGRAFIROVANIYA]
V. L. Lebedev 1970 15 p Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (Moscow), v. 40, 1957 p 156-162
(AD-705815; NOO-Trans-192) Avail: CFSTI CSCL 17/8

By analyzing various methods used in determining the sizes of objects in the sea, notably icebergs and floes, it is found that the photographic method yields most accurate and quick results. Thus, the method is most advantageous from a practical point of view. The calculations and formulas used in connection with photographs are based on approximately 200 tests made during the ninth cruise of the Soviet Whaling Fleet Slava. The relationship between the sizes of photographic images and natural objects is discussed in detail, defining mathematically the functions of focal length, inclination of camera toward the object to be photographed, the elevation of the camera above mean sea level and the effect of ship motion on the distortion of the true size of objects. The empirical formulas and correction of errors and for the improvement of the accuracy of the method are derived, examined and compared with the results of actual measurements. Author (TAB)

N70-34289# Texas Univ., Austin. Electronics Research Center.
OPTICAL HOLOGRAPHIC INTERFEROMETRY FOR SPACE-TIME RESOLVED REFRACTIVE INDEX MEASUREMENTS
Otto M. Friedrich, Jr., Frederic Weigl, and Arwin A. Dougal 25 Jun. 1969 38 p refs
(Grant AF-AFOSR-768-67)
(AD-701422; AFOSR-69-2130TR) Avail: CFSTI CSCL 20/6

Two-beam optical interferometry is extremely valuable for quantitative space-time resolved refractive index measurements. Basically a two-beam optical interferometer consists of an intense light source, high quality plane mirrors, beam-splitters, and a photographic plate or viewing screen. A Mach-Zehnder interferometer arrangement utilizing coherent optical laser illumination is employed for spacetime resolved refractive index measurement of electron-ion gaseous plasmas produced in energetic pulsed pinches, laser-produced plasmas, and in media with thermal and concentration gradients. Double-pulsed Mach-Zehnder interferometry has been developed to provide effective infinite-fringe interferograms using relatively poor optics, simple alignments, low resolution films and a pulsed laser with a standard (approximately 0.1A) linewidth. Optical holographic techniques have been developed to record the total, three-dimensional picture onto a two-dimensional plate of film. As in optical interferometry, the intersection of a test and a reference beam results in an interference pattern--a hologram. For holographic interferometry, the photographic plate or film is exposed twice; one exposure with and a second exposure without the experimental medium in the test beam. Recently, two-wavelength optical interferometry techniques were extended to two-wavelength optical holographic interferometry. Author (TAB)

N70-34298* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTICAL INSPECTION APPARATUS Patent
Willis G. Groth, inventor (to NASA) Issued 25 May 1965 (Filed 26 Oct. 1961) 3 p Cl. 88-14
(NASA-Case-XMF-00462; US-Patent-3, 185, 023; US-Patent-Appl-SN-148001) Avail: US Patent Office CSCL 17H

An optical apparatus is described for determining the roundness and regularity of a cone surface. The device utilizes a ring gage with an inner perimetric surface having a passageway with end openings. The perimetric surface adjacent to one of the end openings is tangent to a select outer perimetric surface of a component adapted to fit the passageway. Any deviation of the select outer perimetric surface of the component from the shaped portion of the gage perimetric surface forms a slip or gap between the two surfaces due to incomplete contact. The light source and optical system provide visual detection of the slit or gap caused by the deviations. R.B.

N70-34357*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO LUNAR MODULE ALIGNMENT OPTICAL TELESCOPE EVALUATION
Indulis Saulietis 9 Jul. 1968 82 p refs
(NASA-TM-X-64343; MSC-68-EG-08) Avail: CFSTI CSCL 17H

The test procedures and significant results of an evaluation of the anticipated alignment optical telescope performance during the prelaunch lunar surface inertial measurement unit alignment are described. Author

N70-34435*# Aerojet-General Corp., El Monte, Calif. Microwave Dept.
MICROWAVE RADIOMETER DATA STUDY, AN ANALYSIS OF SYSTEM ACCURACY, EXCLUDING ATMOSPHERIC AND ANTENNA PATTERN EFFECTS. ADDENDUM A TO PHASE 1 REPORT
22 Aug. 1969 10 p
(Contract NAS9-9383)
(NASA-CR-108567; SD-1344R-1-Add-A) Avail: CFSTI CSCL 14B

An attempt has been made to determine the accuracy with which remote measurements may be made utilizing the airborne microwave radiometer system onboard the NASA NP3A aircraft. Atmospheric effects and antenna pattern effects are not discussed at this time. Effects of radome loss, antenna loss, receiver inaccuracies and recording system inaccuracies have been included in this analysis. Author

N70-34504# Sandia Corp., Albuquerque, N.Mex.
EVALUATION OF PROJECT FIRESCAN AS AN RTG HEAT SOURCE SEARCH AND DETECTION SYSTEM
J. L. Entrekin and L. L. Keller, Jr. Mar. 1970 29 p refs
(SC-DR-70-152) Avail: CFSTI

The U.S. Forest Service Firescan system was evaluated as an airborne detection system for use in the search, detection, and recovery of earth-impacted radioisotope heat sources. Test data and photographic results are presented. Author (NSA)

N70-34508*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 11 PHOTOGRAPHY: 70-MM, 16-MM, AND 35-MM FRAME INDEX

National Space Science Data Center Feb. 1970 132 p
(NASA-TM-X-64350; NSSDC-70-02) Avail: CFSTI CSCL 14E

Indexes of the Apollo 11 photography are presented and include the Hasselblad 70mm photography, the sequence 16mm photography, and the lunar closeup 35mm stereoscopic photography. A separate listing is given for each magazine designation and the information contained is arranged according to the frame number. An identifying description of each photograph, along with other pertinent data concerning the frame, is included. D.L.G.

N70-34558*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif

APPARATUS FOR IONIZATION ANALYSIS Patent Application

Vladimir T. Zaviantseff, inventor (to NASA) Filed 16 Jul. 1970 21 p
(NASA-Case-ARC-10017-1; US-Patent-Appl-SN-55536) Avail: CFSTI CSCL 14B

Apparatus for ionization analysis comprising generally concentric outer and inner tubular shaped electrodes between which a d-c potential is applied so as to produce an electric field therebetween is described. Adjacent scintillating and photoemissive members are mounted inside the inner electrode, and generally aligned front and rear apertures are formed in the electrodes. Positive ions from a source of ions are directed through the front apertures and onto the scintillating member for the production of light pulses therein. Light from the light pulses striking the photoemissive member produces photoelectrons which are directed outwardly from the electrodes through the rear apertures therein. Electron multiplying means may be positioned to receive the photoelectrons for amplifying the same. With this arrangement the d-c potential which produces the electric field functions to accelerate both the incident positive ion beam and the photoelectrons produced by the photoemissive member. NASA

N70-34585# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

TWO-PHASE FLOW AND HEAT TRANSFER IN MULTIROD GEOMETRIES Quarterly Progress Report, 1 Jul.–30 Sep. 1969

Oct. 1969 15 p refs
(Contract AT(03-4)-189)
(GEAP-10114; QPR-16) Avail: CFSTI

The circular tube test section, which was built specially for the measurement of developing two-phase flow, is described. Author (NSA)

N70-34629*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

METHOD AND APPARATUS FOR REMOTE MEASUREMENT OF DISPLACEMENT Patent Application

Robert H. Silver, inventor (to NASA) Filed 13 Oct. 1969 13 p
(Contract NAS7-100)
(NASA-Case-NPO-10778; US-Patent-Appl-SN-865909) Avail: CFSTI CSCL 14B

One or more optically contrasting marks are placed on a test specimen and illuminated while the specimen undergoes testing. The field of the mark or marks, which may include a stationary reference mark, is scanned with an optical system to detect the mark or marks and generate an electrical pulse in response to each mark scanned. The position of each pulse with respect to a reference is then determined graphically or electronically to measure displacement of a given mark. NASA

N70-34637# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.

THE 1000 HOUR-2300 C THERMOCOUPLE STABILITY TESTS

W. C. Kuhlman and W. G. Baxter Washington AEC Oct. 1969 42 p refs
(Contract AT(40-1)-2847)
(GEMP-738) Avail: CFSTI

Two 1000-hour stability tests on small diameter (9 mil wires) thermocouples for measuring the centerline temperature of LMFBR fuel elements were conducted in a helium atmosphere at 2300 C. The first test used high purity hafnia insulators and W versus W-25Re thermoelements. The second test employed high purity thoria insulators and W-3Re versus W-25Re thermoelements. Both tests completed the 1000-hour test period at 2300 C. The W leg of the W, W-25Re thermocouple used with HfO2, was found to be eroded and the W-25Re leg was found to have a higher W content. Both events influenced the emf output of the W,W-25Re thermocouple system. The W-3Re versus the W-25Re thermocouple with ThO2 insulators was found to be more stable over the 1000-hour test period at 2300 C. It is believed that an improved furnace atmosphere (lower O2 content) contributed to the improved performance of the second test. Author (NSA)

N70-34660# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

A WATER-COOLED TWIN CALORIMETER FOR CURIUM SLUG ASSAY

T. S. McMillan Feb. 1970 10 p
(Contract AT(07-2)-1)
(DP-1217) Avail: CFSTI

A water-cooled twin calorimeter of 20 watt capacity was developed to assay routinely the curium-244 content of aluminum-jacketed slugs. The instrument is operated with master-slave manipulators and requires approximately 45 minutes for a determination. Precision is within 2.5%. Author (NSA)

N70-34669* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SIMULATED FUEL ASSEMBLY Patent

Joseph M. Savino and Chester D. Lanzo inventors (to NASA) Issued 7 Sep. 1965 (Filed 31 May 1963) 7 p Cl. 176-19
(NASA-Case-XLE-00724; US-Patent-3,205,141; US-Patent-Appl-SN-284757) Avail: US Patent Office CSCL 14B

A simulated fuel assembly is described containing a flow measuring system for mounting in a reactor core. The assembly comprises a housing that encloses a turbine type flow meter and a flow resistor in the form of a cluster of elongated tubes. The housing configuration is similar to a typical fuel assembly and may be substituted for any fuel assembly in the core. The system rapidly and accurately measures the coolant flow rate through the inside of each fuel assembly under steady and transient conditions. E.C.

N70-34674*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PENETROMETER Patent Application

Isak Kloc, inventor (to NASA) Filed 19 Jan. 1970 17 p
(Contract NAS7-100)
(NASA-Case-NPO-11103; US-Patent-Appl-SN-3654) Avail: CFSTI CSCL 14B

Design data are provided on a penetrometer suitable for use in empirically determining the load-bearing characteristics of inclined surfaces of remotely located bodies of soil. The penetrometer includes a mount rotatably supporting a vertically driven probe, and a terminal pad which can be laterally displaced as it is vertically inserted into the surface of the soil. The extent of vertical and lateral displacement imposed on the pad can be detected and measured to accurately indicate the true load-bearing characteristics of the surface, regardless of its angle of inclination. NASA

N70-34697*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ELECTRO-OPTICAL SCANNING APPARATUS Patent Application

Frederic Crockett Billingsley and John Jay Volkoff, inventors (to NASA) Filed 27 Feb. 1970 12 p
(Contract NAS7-100)
(NASA-Case-NPO-11106; US-Patent-Appl-SN-15020) Avail: CFSTI CSCL 17H

A system for electro-optically scanning variable transmittance objects is described. The system includes a modulated scan-in illuminator and a scan-out photosensor. The scan-in illuminator provides a spot of light of required intensity upon the object. The transmitted light from the object is then optically read by the scan-out photosensor. The scanning sequence of the scan-in illuminator is synchronized with that of the scan-out photosensor. Since a variable light intensity and a variable dwell time are provided in this system, three controlled readout phases are available: constant reduced light intensity and dwell time, variable light intensity and constant dwell time, and constant maximum light intensity and variable dwell time. These readout phases enable the system to readout an extended dynamic range of the object.
NASA

N70-34705* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FORCE MEASURING INSTRUMENT Patent
Lester Katz and Jack J. Nichols, inventors (to NASA) Issued 19 Oct. 1965 (Filed 30 Jul. 1963) 4 p Cl. 73-88.5
(NASA-Case-XMF-00456; US-Patent-3,212,325;
US-Patent-Appl-SN-298800) Avail: US Patent Office CSCL 14B

An instrument for measuring forces in a strain-subject structural member is described. The instrument senses strain and indicates load or stress in a fastening member such as a bolt or stud. It is reusable, compact, and highly accurate.
E.C.

N70-34752# California Univ., Livermore. Lawrence Radiation Lab.
HAZARDS CONTROL Progress Report, Sep. – Dec. 1969
Dec. 1969 50 p refs
(UCRL-50007-69-3; PR-35) Avail: CFSTI

A description of the new walk-in hood for radiation hazards control at the decontamination facility is given. The design, construction, and preliminary calibration of a sodium iodide scintillation gamma dector for plutonium 239 determination in drums containing contaminated waste are described. The development and operation of a recycling generator-scaler system with an ionization chamber for monitoring stack effluents are also summarized. The installation and effectiveness of a graded shield liner for the underground whole-body counting room are briefly reviewed. Variations in the natural background radiation in the energy range from 10 to 100 keV were measured at selected sites in the Livermore Valley with a FIDLER detector (Field Instrument for Dectection of Low Energy Radiation).
J.A.M.

N70-34775# Joint Publications Research Service, Washington, D.C.
METHOD OF RADIO ASTRONOMICAL OBSERVATIONS AND EQUIPMENT CONSTRUCTION PRINCIPLES
Arkadiy Petrovich Sivers 21 Jul. 1970 20 p Transl. into ENGLISH from the book 'Osnovy Kosmicheskoy Radioelektroniki' (Moscow), 24 Oct. 1969 p 108 – 127
(JPRS-50993) Avail: CFSTI

During the process of radio astronomical observation, the following problems are solved: (1) measurement of the force of extraterrestrial radiation arriving from various directions; (2) determination of the radiation spectrum; and (3) determination of the polarization characteristics of the radiation. Depending on the type of source, the following instruments are used for the listed purposes: radiotelescopes, radiointerferometers, radiospectrometers, and radiopolarimeters. Radiotelescopes permit measurements of the intensity of extraterrestrial radiation arriving from various directions depending on antenna arrays, etc. Radiointerferometers determine size and brightness distribution of point sources. Radiospectrometers are used to observe spectral radiation characteristics of neutral hydrogen and the sun. Radiopolarimeters use linearly polarized antennas to separate signals into circular-polarized components in order to determine polarization radiation characteristics.
G.G.

N70-34794* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SEISMIC DISPLACEMENT TRANSDUCER Patent
Thomas L. Greenwood, inventor (to NASA) Issued 13 Jul. 1965 (Filed 30 Jan. 1962) 8 p Cl. 73-71.2
(NASA-Case-XMF-00479; US-Patent-3,194,060;
US-Patent-Appl-SN-169977) Avail: US Patent Office CSCL 17J

A vibration measuring device for low frequencies of moderate to large magnitude is described for determining the swaying of buildings and other structures without fixed references, and when the frequency may be less than one cycle per second. This seismic displacement transducer consists of a pendulum pivoted on a frictionless point, and has attached an unbalancing spring acting directly across the pivot point which permits low-frequency oscillation.
F.O.S.

N70-34799* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACCELEROMETER WITH FM OUTPUT Patent
Edward J. Kirchman, and Raymond G. Hartenstein, inventors (to NASA) Issued 10 Aug. 1965 (Filed 29 May 1963) 3 p Cl. 73-88.5
(NASA-Case-XLA-00492; US-Patent-3,199,340;
US-Patent-Appl-SN-284265) Avail: US Patent Office CSCL 14B

A simple, small, rugged, lightweight accelerometer with FM signal indicative of the mechanical strain to which it is subjected is described. A resistor, variable voltage source, p-n-p-n transistor with a negative resistance characteristic, and two strain sensitive devices are connected in series. The voltage source is varied until oscillations are caused, and the oscillation produce a constant frequency signal across the resistor. When the strain sensitive devices are subjected to a strain, the resistance changes, varying the frequency of the signal across the resistor in accordance with the strain. The instrument can be used to measure mechanical vibration, mechanical strain, or any phenomena which can be translated into mechanical displacement.
N.E.N.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-33483# Politecnico di Torino (Italy). Ist. di Tecnologia Meccanica.
ADAPTIVE CONTROL IN TURNING: CUTTING FORCES AND TOOL WEAR RELATIONSHIP FOR P 10, P 20, P 30 CARBIDES
A. De Filippi and R. Ippolito 1968 41 p refs Presented at CIRP Ann. Assembly, Nottingham, Engl., Sep. 1968
Avail: CFSTI

Turning tests using ISO P 10, ISO P 20, and ISO P 30 carbides as the tool materials are reported. The work materials were AISI 8640 and AISI 1030 steels, and several cutting speeds and feed speeds were used. The wear and force values at preset time intervals were determined. The cutting force behavior is plotted as a function of time for the various combinations tested, and

the characteristics of each carbide are discussed. It is concluded that the data indicate a relationship between cutting force and tool wear. N.E.N.

N70-33473# Politecnico di Torino (Italy). Ist. di Tecnologia Meccanica.
EVALUATION OF THE TOOL WEAR IN FRONTAL MILLING
Augusto de Filippi and Rosolino Ippolito 1969 24 p refs Presented at CIRP Ann. Assembly, Geneva, Sep. 1969
Avail: CFSTI

A set of milling tests was made in order to show the correlation between cutting forces and tool wear. The cutting torque was measured with a strain gage torquemeter. The results show that the slope of the straight line cutting force versus wear is steeper in milling than in turning. Therefore the force can be considered as a wear transducer with a high sensitivity, which is important for adaptive control. Author

N70-33474# Politecnico di Torino (Italy). Ist. di Tecnologia Meccanica.
ANALYTICAL STUDY OF FLEXURAL AND TORSIONAL VIBRATIONS OF BORING HEADS
Sergio Rossetto and Anna Verrini Mar. 1969 33 p refs Presented at CIRP Ann. Assembly, Geneva, Sep. 1969
Avail: CFSTI

A comparison of three boring head designs was performed using two computer programs. Engineering drawings were used as the only source of input data. It was found that the first natural bending frequency of the spindle-bearings assembly corresponds to the first free-free bending mode of the spindle. If the spindle is supported by four bearings with the mass distribution and bearing stiffness range considered, the first mounted frequency is higher than the free-free one. A sizeable increase in bearing stiffness leads to a small increase in the first natural frequency value. When considering forced vibrations not only the force applied to the spindle nose but also the bending moment must be considered. The boring bar length must also be taken into account. The first torsional frequency of the spindle by itself is much higher than the corresponding bending one. When the whole spindle and drive system is considered, natural torsional modes are found to occur at much lower frequency. Author

N70-33591# Politecnico di Torino (Italy). Ist. di Tecnologia Meccanica.
RESEARCH ON THE RELATIONSHIP BETWEEN THE CHIP SLENDERNESS RATIO AND THE SHEAR ANGLE
G. Perotti 1968 19 p refs Presented at CIRP Ann. Assembly, Nottingham, Engl., Sep. 1968
Avail: CFSTI

Plane strain conditions were set up in an investigation of the relationship between the shear angle and the slenderness ratio in orthogonal cutting. Reliance is placed on a cutting theory based on the plasticity of the material, in the derivation of equations to be used in the calculation of hydrostatic stress values in function of the shear angle. A relationship between hydrostatic stress and slenderness ratio is then considered. A connection found between slenderness ratio and shear angle is shown to be in close agreement with the experimental data, in particular in the case of slenderness ratio values which are most likely to be accompanied by plane strain. Author

N70-33608# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF STEEL ROPE JUNCTIONS [INSPECAO ULTRA-SONICA DE MANILHAS DESTINADAS A CABOS DE ACO]
Helsion Onusic and E. J. Cury 24 Oct. 1969 5 p In PORTUGUESE; ENGLISH summary
(TN-6910-389) Avail: CFSTI

Descriptions of the inspected parts, the procedure and the results of ultrasonic inspection of steel rope junctions of forged steels are presented. Author

N70-33653# National Research Council of Canada, Ottawa (Ontario). Flight Research Lab.
PRODUCTION OF PRECISION FOAM PLASTIC PRODUCTS BY PRESSURE MOLDING OF FOAM SLABS IN A HOT MOLD
D. A. Baker *In its* The Div. of Mech. Eng. and the Natl. Aeron. Estab. 31 Dec. 1969 p 39-45 (See N70-33651 18-34)
Avail: CFSTI

A method is described for molding model crash position indicators, which will be used in supersonic wind tunnel tests, from blocks of styrofoam. It also briefly describes methods that were tried before reaching a satisfactory one, and lists a few areas where this type of manufacture might prove valuable. Author

N70-33680# Air Force Missile Development Center, Holloman AFB, N.Mex.
RESULTS OF AIR BEARING SLIPPER TESTS ON THE HOLLOMAN ROCKET SLED TEST TRACK, JULY 1966-SEPTEMBER 1968
Michael F. Hess and Richard C. Meier Apr. 1970 116 p refs (AD-705586; MDC-TR-70-19) Avail: CFSTI CSCL 14/2

An analysis and evaluation was made of the effectiveness of air bearing slippers. The slippers tested were not externally pressurized but rather were designed to compress high pressure ram air inside the slippers by means of a fore to aft converging slipper-rail gap geometry. Both standard and air bearing slippers were instrumented for pressure measurements and tested at speeds up to Mach 3.75 on 9-inch diameter monorail sleds. The test results consist of oscillatory load measurements as well as pressure measurements obtained from a twelve channel telemetry package. The following parameters were varied during the tests: type of slipper, slope of center portion of the upper inside slipper surface, height of the center portion of the upper slipper surface from the rail, and Mach number of the sleds. The results presented include possible explanations for the lack of correlation between the predicted and the measured pressures and suggestions to increase the usefulness of the air bearing slippers by reducing the high oscillatory loads. Author (TAB)

N70-33681# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
POWER TRANSFER IN EPICYCLIC GEARS AT STATIC AND DYNAMIC OPERATION: CALCULATION OPTIMIZATION, EXPERIMENT RESULTS [LEISTUNGSUEBERTRAGUNG IN PLANETENGETRIEBEN BEI STATISCHEM UND DYNAMISCHEM BETRIEB: BERECHNUNG, OPTIMERUNG, VERSUCHSERGEBNISSE]
Karl Stoelzle (Ph.D. Thesis) 19 Feb. 1970 145 p refs in GERMAN
Avail: CFSTI

Power transfer during static and dynamic operation of epicyclic drive gear trains is analyzed by considering equations of motion, as well as equations for torques, capacity, and efficiency for gear trains having a degree of freedom of about 2. Dimensional representation of the basic touring number equation for a spatial bevel gear-epicyclic drive gives a presentation of the induction regions from which general formulas for degrees of efficiency are deducted. Example calculations on the superimposed gear drive for a gaseous pressure system show a relative large variable turing number range; this establishes that hydrostatic superimposition units are subjected to high loads which in turn effect their fatigue life. Transl. by G.G.

N70-34018 Politecnico di Torino (Italy).
PREDETERMINATION OF THE DYNAMIC CHARACTERISTICS OF MACHINE TOOLS. PART ONE [PREDETERMINAZIONE DELLE CARATTERISTICHE DINAMICHE DELLE MACCHINE UTENSILI, PARTE PRIMA]
Gian Federico Micheletti, Sergio Rossetto, Anna Verrini, and Raffaello Levi Milan CNR 1968 142 p refs In ITALIAN Sponsored by CNR
Copyright. Avail: Issuing Activity

Results of research on the automation of industrial machinery is reported with special emphasis on machine tools. A mathematical method is given for predicting the static and dynamic behavior of a structure without resorting to a physical model or experimentation. Examples of calculating mechanical properties for various sections of machine tools are included. Transl. by F.O.S.

N70-34041# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FRICTION AND WEAR IN MACHINERY, NO. 20, 1968
G. I. Yakunin et al 27 Mar. 1970 95 p refs Transl. into ENGLISH from Trenie i Iznos v Mashinakh, Akad. Nauk SSSR, Inst. Mashinoved., Sb. (Moscow), no. 20, 1968 p 91-105, 128-177
(AD-705843; FTD-MT-24-444-69) Avail: CFSTI CSCL 13/9

Contents: New investigations of the wear process of friction surfaces; Design of machine parts for wear; Effect of alloying on antifriction properties of binary alloys of copper during friction under conditions of boundary lubrication; and Antifriction properties of solid lubricating coatings in an atmosphere of inert gas and in vacuum. TAB

N70-34076*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
CERAMIC-METAL BORE SEAL DEVELOPMENT
P. E. Kueser, M. F. Parkman, and J. W. Toth Washington NASA Jul. 1970 180 p refs
(Contract NAS3-6465)
(NASA-CR-1591; WAED-67.48E) Avail: CFSTI CSCL 11A

A potassium-resistant bore seal capsule was fabricated. The ceramic used was low-silica 99.8 percent beryllia, and the metal end bells were made from columbium-1 percent zirconium sheet. Joining was accomplished with an active-metal brazing alloy having a composition in weight percent of 60Zr-25V-15Cb. After fabrication the capsule was loaded with 4 grams of high purity potassium and sealed while in a vacuum chamber. The bore seal capsule was exposed for 5000 hours at 1300 F in an ion-pumped thermal vacuum chamber with pressures in the 10 to the minus 9 power torr range. During this test exposure, the capsule remained potassium leak-tight. A variety of materials were tested during the program. Equipment and processes were developed for ceramic to metal brazing, brazement testing, and for alkali metal loading. A study was conducted on the outgassing characteristics of ceramics that had been fabricated by different methods. High purity alumina and beryllia ceramics and a series of brazing alloys were used in fabricating brazements. Selected brazements were evaluated for strength, leak tightness, and compatibility with potassium or lithium exposure at temperatures through 1600 F. Author

N70-34180# Plastics Technical Evaluation Center, Dover, N.J.
LITERATURE SEARCH: INJECTION MOLDING PROCESSING PARAMETERS
Nicholas T. Baldanza Jul. 1969 36 p refs
(AD-703530; PLASTEC-21) Avail: CFSTI CSCL 11/9

This study is concerned with the relationship between processing parameters and the physical and mechanical properties of injection molded parts thus produced. Subjects of primary interest were: injection pressure and temperature; mold temperature and molding cycle; flow rate, shear rate, melt viscosity and elastic shear stresses of plastic in the mold; internal stresses in the molded part; and instrumentation for measurement of these parameters. A total of 164 references are cited. The high-lights of these various pieces of information are discussed. Author (TAB)

N70-34240 National Lending Library for Science and Technology, Boston Spa (England).
STRIP CASTING IN STATIONARY MOULDS [BANDGIESSEN IN STATIONAEREN KOKILLEN]
G. Muritz 24 Jun. 1970 14 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 60, no. 9, Sep. 1969 p 694-698
(NLL-M-9231-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Direct-chill casting molds for use in the aluminum industry are discussed. The difficulties in strip casting are shown to be: (1) At high casting rates the strand emerging from the mold has a liquid core with a thin solidified skin, so that there is a danger of break out. (2) Al tends to stick to the molds. (3) High casting rates increase internal tensions, and the tendency to cracking. Some measures to correct these disturbing effects are presented. F.O.S.

N70-34247* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VENTING VAPOR APPARATUS Patent
Richard J. Weber, inventor (to NASA) Issued 18 Dec. 1962 (Filed 19 Jun. 1961) 3 p Cl. 62-50
(NASA-Case-XLE-00288; US-Patent-3,068,658; US-Patent-Appl-SN-118200) Avail: US Patent Office CSCL 13K

A tank pressure-relief device is described for venting cryogenic liquid vapors. The cryogenic fluid is vented through tubes with a porous plug and valve. The valve is designed to open upon being subjected to a predetermined tank pressure, which permits the flow of cryogenic fluid through the porous plug. While passing through the porous plug, the cryogenic fluid undergoes a constant-enthalpy expansion process, permitting vapors to escape freely and freezing nonvapors. R.B.

N70-34249* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRICAL DISCHARGE APPARATUS FOR FORMING Patent
Robert J. Schwinghamer, inventor (to NASA) Issued 15 Jun. 1965 (Filed 17 Jan. 1962) 4 p Cl. 72-56
(NASA-Case-XMF-00375; US-Patent-3,188,844; US-Patent-Appl-SN-166969) Avail: US Patent Office CSCL 13I

The apparatus has a blast head with a cone-shaped chamber and die block which has a forming cavity aligned with the chamber. A metal blank adapted for forming separates the chamber from the forming cavity. Within the chamber and adjacent to the apex are two spaced electrodes having a metal wire connected between them, with a V-shaped portion converging away from the apex. A pressure transmitting liquid is contained within the blast chamber and the two electrodes are electrically connection to a condenser bank. When the condenser bank is discharged, the wire explodes and generates a shock wave which is transmitted through the liquid to the blank. R.B.

N70-34302*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROSPACE LUBRICATION FOR ADVANCED VEHICLES
R. L. Johnson and E. J. Mengeniello 1970 16 p refs Proposed for Presentation at German Soc. of Tribiology Ann. Meeting, Essen, 22-23 Sep. 1970
(NASA-TM-X-52867; E-5831) Avail: CFSTI CSCL 11H

Some lubrication studies pertinent to the shuttle are reviewed with special reference to the airbreathing engines where requirements are similar to those for future aircraft. The trends in airbreathing engines are toward more severe conditions such as

higher rotative speeds and higher temperatures with the shuttle adding special seal problems. Some data on lubrication methods for use at higher temperatures and speeds indicate promise for mist systems and inerted or closed systems. Mainshaft face type seals with Rayleigh step lift-pad geometry perform well under extreme conditions. Lubricant limitations are described and successful operation at high temperatures is reported. A synthetic paraffin liquid lubricant provided extended operation of engine bearings at 650 F in an inerted atmosphere and a CaF2 base solid lubricant allowed operation of ball bearings to 1500 F for periods up to 150 hours. Improvements in application of MoS2 by vacuum deposition methods give evidence that the stalwart lubricant of past space vehicles can have the extended durability needed for the shuttle and space stations. Author

N70-34364 National Lending Library for Science and Technology, Boston Spa (England).
HOT-DIP ALUMINIZING OF COLD-ROLLED STEEL STRIPS [ALUMINIOWANIE OGNIOWE TASM STALOWYCH WALCONANYCH NA ZIMNO]
R. O'Donnal Apr. 1970 36 p refs Transl. into ENGLISH from Probl. Projektowe (USSR), no. 3, 1969 p 80–89
(NLL-RTS-5637) Avail: Natl. Lending Library, Boston Spa, Engl.: 25s or 3 NLL photocopy coupons

The technology of hot dip aluminizing of cold rolled steel, the properties and uses of the strips, and the production techniques are discussed. Author

N70-34523# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EVALUATION OF 3/32 INCH FILLET WIRE-END CAP WELD
R. L. Myers Apr. 1970 20 p refs
(Contract AT(45-1)-1830)
(BNWL-1332) Avail: CFSTI

A study of the 3/32 in. fillet wire-end cap weld was made to determine the characteristics of this welding technique. The test samples were similar to actual wire-end cap welds used on fuel pins. The welding parameters were controlled and recorded. A visual examination revealed only minor dimensional variations in the length of the weld. Radiography showed that 3 of the 22 welds lacked penetration. When tensile tested, strength of the welds was found to be inversely proportional to the amount of penetration. All samples fractured on the wire side of the welds. Good resistance to corrosion was demonstrated in oxalic acid etch tests. Metallography confirmed previous radiography results and revealed that the amount of necking in the wire next to the weld increased as penetration increased. Author (NSA)

N70-34524# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EVALUATION OF WELD JOINT DESIGNS BETWEEN WIRE WRAP AND END CAP
R. L. Myers Apr. 1970 10 p refs
(Contract AT(45-1)-1830)
(BNWL-1331) Avail: CFSTI

A preliminary study of potential problems associated with five different wire to end cap joint designs was conducted. The designs included a 45 deg hole, 90 deg hole, 45 deg groove, small and large tangent welds. Tensile test results indicated sufficient strength can be attained by using any of the five joint designs. Fabrication techniques pose various problems that are minimal with the 90 deg hole and small tangent weld designs. Author (NSA)

N70-34555*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
AIR BEARING Patent Application
James W. Maddox and Frank T. Wolf, inventors (to NASA) Filed 17 Jun. 1970 10 p
(NASA-Case-WLP-10002-1; US-Patent-Appl-SN-47082) Avail: CFSTI CSCL 13I

An air bearing for use in an exterior environment to facilitate movement of a heavy load in a horizontal plane is described. The device includes a flexible peripheral seal to direct the flow of pressurized air toward a metal plate surface and toward a central air outlet, and a floating wiper circumferentially disposed about the air bearing body to keep sand and dirt off the bearing lifting area. NASA

N70-34641*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
METHOD OF TREATING METALLIC SURFACES Patent Application
William F. Mac Glashan, Jr., inventor (to NASA) Filed 31 Dec. 1969 12 p
(Contract NAS7-100)
(NASA-Case-NPO-10779; US-Patent-Appl-SN-889552) Avail: CFSTI CSCL 13H

A method is described for improving the resistance of a smooth metallic surface to corrosion, erosion, and other adverse effects. The method includes coating with diamond particles. The diameters of the particles depend on the particle phenomenon for which increased resistance is desired. The diameters may vary from 0.01 micron to over 0.25 micron. The diamond-coated surface is then pressed or tapped against the surface which is treated until the diamond particles are impregnated in the metal. NASA

N70-34652*# Northrop Corp., Hawthorne, Calif. Nortronics Div.
METHOD OF REMOVING INSULATED MATERIAL FROM INSULATED WIRES Patent Application
Frank B. Ramge, inventor (to NASA) Filed 31 Dec. 1969 14 p
(Contract NAS4-1133)
(NASA-Case-FRC-10038; US-Patent-Appl-SN-889554) Avail: CFSTI CSCL 13H

A method of fabricating equal length insulated wires which have the insulation removed from selected portions of the wire is described. Such wires have use as leads of bio-potential electrodes. As the insulated wire is passed through a jig, it is struck by a stream of abrasive material which removes the insulation on selected portions of the wire. NASA

N70-34664* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXTERNALLY PRESSURIZED FLUID BEARING Patent
Emmett L. Martz, inventor (to NASA) Issued 10 Aug. 1965 (Filed 7 May 1963) 7 p Cl. 308-9
(NASA-Case-XMF-00515; US-Patent-3,199,931; US-Patent-Appl-SN-278790) Avail: US Patent Office CSCL 13I

An air bearing in which a small volume of low pressurized air acts as the lubricant is described. An annular reservoir of constant pressure is within the encircling members, and an annular restriction of constant width and length restrict the fluid flow creating a pressure potential. It is felt that the design is applicable to bearings of gyros operating in a high temperature and low gravity environment where turbine torque is substantially eliminated. N.E.N.

N70-34699*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID JUNCTION AND METHOD OF FABRICATING THE SAME Patent Application
Stephen P. Vango, inventor (to NASA) Filed 27 Feb. 1970 12 p
(Contract NAS7-100)
(NASA-Case-NPO-10682; US-Patent-Appl-SN-15023) Avail: CFSTI CSCL 13H

A restricted junction element suitable for use as a glass electrode or membrane in pH meters and the like or for feeding a liquid very slowly from a reservoir is formed by longitudinally scoring a section of a glass rod, cracking it by stressing along the

score lines, realigning the portions of the cracked section of their original relative positions, and fitting them within a glass tube to the interior wall of which they are then fused. NASA

N70-34762*# Martin Marietta Corp., Denver, Colo.
STUDY OF TOOLING CONCEPTS FOR MANUFACTURING OPERATIONS IN SPACE Final Report
Wayne D. Faber, Fredrick J. Greeb, and Robert E. Boyd 26 Apr. 1969 161 p refs
(Contract NAS8-21279)
(NASA-CR-109989; MCR-69-220) Avail: CFSTI CSCL 13I

The Serpentuator concept, which represents a unique approach to space mobility problems, is discussed. The device consists of a number of powered links which can be actuated relative to each other, such that the Serpentuator tip can be placed anywhere within a spherical volume. This mechanical linkage can serve as a means of transport, guidance, stabilization, and rendezvous for space manufacturing operations. The device can be used either internally in the space cluster or externally, and allows a flexibility not contained in other mobility devices. The Serpentuator application to current AAP experiments is discussed and a brief review is presented of the compatibility analysis of ATM experiment requirements for Serpentuator application. In addition, a large class of orbital EVA operations are analyzed, comparing the Serpentuator with other mobility devices. Author

N70-34769 National Lending Library for Science and Technology, Boston Spa (England).
THE SHAPE OF INTERBLADE CHANNELS IN THE IMPELLERS OF STATIONARY COMPRESSORS [O FORME MEZHLOPATONALOV KOLES STATSIONARNYKH KOMPRESSOROV]
K. P. Seleznev et al Jun. 1970 19 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), no. 5, 1969 p 23–27
(NLL-RTS-5564) Avail: Natl. Lending Library, Boston Spa, Engl.: 36s or 6 NLL photocopy coupons

Experimental studies and computer calculations of quasi-three-dimensional flow are reported for the design of interblade channels in the runners of stationary centrifugal compressors which differ either in the shape of blade camber line or in the configuration of the shroud. Results are analyzed for differences in radial distribution of pressure variations between pressure and suction surfaces of the blades (or load). A simple approximation method for designing interblade channels from a given load distribution law is proposed. G.G.

N70-34784*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
MANUAL FOR OPERATION OF AUTOMATIC PIPE AND TUBE WELDING MACHINE
W. E. Clautice 21 May 1969 68 p refs
(NASA-TM-X-64399; KSC-GP-630) Avail: CFSTI CSCL 13H

The APW-3 (Modified) Automatic Pipe Welding System consists of three functional subsystems, each with attached and attachable functional components. The three subsystems are: the APW-3 power supply, the controls, and the carriage and torch assembly. The APW-3 power supply consists of a power supply unit with an attached high frequency panel, a fuse assembly, and a shunt (connector) box which are attachable to the HF panel. The power supply operates from a 480 vac, 3-phase, 4-wire, 60 cycle single source power outlet, with a useful output voltage range of 5-40 vdc; 80 volts open circuit, and has a power factor of 0.74. The rated output is 230 amps DC at 100 percent duty cycle; 300 amps DC at 60 percent duty cycle, with a useful output current range of 6 - 450 amps DC at 25 percent duty cycle. The APW-3 power supply is a portable unit with a built-in lift hook, a fail safe device under the top panel that limits maximum current, and a HF panel attached to its hinged right side panel. The supply unit is a major component of the supply system and functions to provide the automatic pipe welding system with a controlled output power supply. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-33447# Flying Personnel Research Committee, London (England).
LASER IRRADIATION OF THE ANTERIOR SEGMENT OF THE EYE: RABBIT EYES
Vivienne L. Hallman (Inst. of Ophthalmol., London), E. S. Perkins (Inst. of Ophthalmol., London), G. K. Watts (Inst. of Ophthalmol., London), and C. B. Wheeler (Inst. of Ophthalmol., London) Jan. 1969 19 p refs
(FPRC/1285(a)) Avail: CFSTI

Ruby lasers with power outputs of 230 and 800 ms caused no detectable lesions in the transparent media of the eye but produced marked changes in the iris of pigmented animals. Repeated exposures were required to produce a hole in brown irises but a hole resulted from a single exposure in a blue iris. A 3 mW continuous argon laser caused corneal edema after 1-1/2 min exposure. The histological appearances of the ruby laser lesions on the iris are described, and the possible clinical applications discussed. Author

N70-33448# Flying Personnel Research Committee, London (England).
LASER IRRADIATION OF THE ANTERIOR SEGMENT OF THE EYE. 2: MONKEY EYES
Vivienne L. Hallman (Inst. of Ophthalmol., London), E. S. Perkins (Inst. of Ophthalmol., London), G. K. Watts (Inst. of Ophthalmol., London), and C. B. Wheeler (Inst. of Ophthalmol., London) Jan. 1969 15 p refs Supported by Min. of Aviation and Min. of Defence
(FPRC/1285(b)) Avail: CFSTI

The lesions produced in the iris of cynomolgus monkeys by a pulsed ruby laser are described and compared with those produced in pigmented rabbits. Differences in the reaction of the iris tissue in the two species can be explained by differences in anatomical structure. Pigment liberated from the iris could be seen to leave the anterior chamber by infiltration between the muscle layers of the ciliary body. Author

N70-33460*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPTICAL SYSTEMS AND STATION PROCEDURES FOR THE SURVEYOR 7 LASER POINTING TEST
M. S. Shumate, comp. *In its* Analysis of Surveyor Data 30 Jun. 1970 p 125–134 (See N70-33455 18-30)
Avail: CFSTI

The Surveyor 7 laser pointing test, conducted during the active portion of the Surveyor 7 mission, served to verify procedures for aiming lasers at a specific point on the lunar surface. A description of the optical systems and alignment procedures used by each of the six earth-based stations participating in the test is presented. During one phase of the Surveyor 7 mission on the lunar surface, the television camera was used to take pictures of the earth while several earth-based stations were aiming argon-ion laser beams at the Surveyor 7 position. All six stations used argon-ion lasers as the light source, and reduced the laser output beam divergence to acceptably small angles by the use of beam expanding telescopes. The expanded beams were then aimed at the Surveyor 7 position on the lunar surface. Author

N70-33485# Atomic Weapons Research Establishment, Aldermaston (England).
THE PREPARATION OF THE LIQUID LASER SOLUTION Nd(3+)/SeOCl2 AND ITS LASER CHARACTERISTICS IN NON-RESONANT CAVITIES
D. J. Hunt and T. M. Shepherd Jun. 1970 22 p refs
(AWRE-O-41/70) Copyright. Avail: HMSO 5s; BIS $1.00

The preparation of the high gain liquid laser solution Nd(3+)/SeOCl2 is described in detail. The results of preliminary experiments using simple non-resonant laser cavities are presented and discussed. A number of unusual phenomena have been discovered. Comparison is made with solid state laser materials and possible applications are outlined. Author

N70-33881# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
GAS DISCHARGE NOISE AND THE LASER OUTPUT
James Yoh and Nicholas George Jan. 1970 28 p refs
(Grant AF-AFOSR-1492-68)
(AD-705620; AFOSR-70-0899TR) Avail: CFSTI CSCL 20/5

The effect of moving striations on the performance of a gas laser is studied. A traveling periodic stratification in dielectric constant is shown to separate each resonant cavity mode into a multi-tone spectrum. Verification of this theory is provided by an experimental study of the spectra of the output of a helium-neon laser in the LF, RF and optical frequency ranges. Author (TAB)

N70-33936# TRW Systems, Redondo Beach, Calif.
DEFORMATION OF THIN PLATES BY STRESS WAVES GENERATED IN CONFINED LASER HEATED PLASMAS
C. H. Skeen, J. Dugan O'Keefe, D. L. Crouse, C. N. Mc Dowell, and C. M. York Nov. 1969 91 p refs Prepared for Sandia Corp.
(SC-CR-69-3306) Avail: CFSTI

A preliminary investigation of using a conventionally Q-switched laser as a source of intense electromagnetic radiation for inducing stress waves in solids is presented. In this investigation the possibility of measuring and interpreting the stress waves to obtain the Hugoniots of solids was explored. This investigation included the determination of the stress pulse amplitudes obtainable with the laser system. In this investigation both new and well tested techniques were used for measuring shock wave parameters. In addition a theoretical model of the initiation and evolution of the stress waves was developed. The results of this investigation are discussed. Author

N70-34554*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
OPTICAL PUMP AND DRIVER SYSTEM FOR LASERS Patent Application
Horace W. Furumoto and Harry L. Ceccon, inventors (to NASA) Filed 21 May 1970 18 p
(NASA-Case-ERC-10283; US-Patent-Appl-SN-39185) Avail: CFSTI CSCL 20E

A laser pumping system including a xenon filled coaxial flashlamp mounted on a driver assembly and a cylindrical capacitor and integrally mounted spark gap switch is described. Because of low inductance circuitry and the use of a switch to prevent premature breakdown of the xenon gas, an extremely uniform high power discharge is created in the flashlamp by a photoionization process. NASA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-33440# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
TRANSFORMATION PROCESSES IN SOME URANIUM ALLOYS WITH LOW PERCENTAGES OF MOLYBDENUM AND NIOBIUM [PROCESSI DI TRASFORMAZIONE IN ALCUNE LEGHE DI URANIO A BASSO TENORE DI MOLIBDENO E NIOBIO]
L. Castaldelli, C. Fizzotti, and A. G. Gandini 28 Mar. 1969 43 p refs In ITALIAN
(RT/MET(69)2) Avail: CFSTI

The TTT curves are shown and discussed for uranium alloys containing 1% molybdenum; 1% niobium; 0.5% molybdenum + 0.5% niobium; and 0.2% molybdenum + 0.7% niobium. Transformations occurring at particular temperatures are discussed together with the morphology of the precipitated phases. Author

N70-33466# Naval Research Lab., Washington, D.C.
ARPA COUPLING PROGRAM ON STRESS-CORROSION CRACKING Quarterly Report
G. Sandoz Mar. 1970 69 p refs
(ARPA Order 878)
(AD-706016; NRL-MR-2101; QR-13) Avail: CFSTI CSCL 11/6

A progress report of the research investigations being carried out on the problem of stress-corrosion cracking of high strength materials under ARPA Order 878 is presented. Work at Carnegie-Mellon University, Lehigh University, Georgia Institute of Technology, The Boeing Company, American University, and the Naval Research Laboratory concerning test techniques, materials characterization, physical metallurgy, surface studies, and corrosion fatigue is described. The report is divided into three main sections covering work on high strength titanium, steel, and aluminum. Included is a section containing abstracts of recently published reports, journal articles, and talks generated under ARPA Order 878. Selected abstracts of articles from outside the ARPA program in the field of stress-corrosion cracking are also included as well as a Diary of Events section. Author (TAB)

N70-33478# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
TRANSFORMATION PROCESSES IN URANIUM ALLOYS CONTAINING 2% MOLYBDENUM AND 2% NIOBIUM [PROCESSI DI TRASFORMAZIONE IN LEGHE DI URANIO CONTENENTI 2% DI MOLIBDENO E 2% DI NIOBIO]
L. Castaldelli, C. Fizzotti, and A. G. Gandini 28 Nov. 1969 36 p refs In ITALIAN; ENGLISH summary
(RT/MET(70)2) Avail: CFSTI

TTT curves of two uranium alloys containing 2w/o molybdenum and 2w/o niobium are shown and discussed together with the different transformations occurring in these alloys at particular temperatures. Author

N70-33498# Birmingham Univ. (England). Dept. of Physical Metallurgy and Science of Materials.
THERMODYNAMICS OF ALLOYS. CALORIMETRIC STUDIES OF MANGANESE-COPPER AND PALLADIUM-ALUMINIUM ALLOYS Final Technical Report, Jan. – Dec. 1969
J. N. Bratt and A. W. Bryant Dec. 1969 36 p ref
(Contract DAJA37-69-C-0472)
(AD-705644) Avail: CFSTI CSCL 11/6

Tin solution calorimetry was employed in the measurement of heats of formation of the face-centered gamma-phase copper-manganese solid solutions at 320K. The results show that the alloys are characterized by moderately endothermic heats of formation of asymmetric form; the values rise to a maximum of approximately 1 Kcal/g.atom at about 80 atom% Mn. Combinations of the calorimetric heats with the published free energy data indicate the existence of positive excess entropies of formation. The thermodynamic characteristics are attributed to bonding and

vibrational changes rather than magnetic effects. Using a technique based on the precipitation of an alloy from solution in liquid tin the heat of formation of PdAl (FeSi structure) has been determined. New measurements are reported for the isothermal heats of manganese, copper, aluminum and palladium at infinite dilution in liquid tin at 656K. Author (TAB)

N70-33534# United Kingdom Atomic Energy Authority, Risley (England). The Reactor Group.

BIBLIOGRAPHY ON LIQUID METALS, 1966–1967

S. H. Fenney Sep. 1969 111 p refs

(TRG-Inf-Ser-312(R)-Suppl-2) Avail: AEC Depository Libraries

Nine hundred unclassified references to the literature on liquid metals, particularly Na and Na/K are presented. They cover material published in 1966 and 1967, and are a further continuation of TRG Information Series 312 (R), the 1st Supplement to which covered the years 1964 and 1965. Author (NSA)

N70-33555# Atomic Weapons Research Establishment, Aldermaston (England).

IDENTIFICATION OF THE PROTECTIVE OXIDE FILM FORMED ON A Co-Cr-Mo ALLOY

A. N. Hughes and R. A. Lane Jun. 1970 14 p refs

(AWRE-O-18/70) Copyright. Avail: HMSO 2s; BIS $0.50

Polarization curves were obtained for specimens of an as-cast Co-Cr-Mo alloy with the nominal composition 65% Co, 29% Cr, 6% Mo, 0.35% C. The prepared surface of the specimens was polished to a 600 emery grit finish. Potentiostatic conditions were maintained by a Witton Electronics T6 Tutorial Potentiostat used in conjunction with an Avo-meter, a platinum auxiliary electrode and a saturated calomel electrode as reference. The cell electrolyte was an 0.17M NaCl solution buffered to pH 7.4 with sodium carbonate and maintained at 37 C. A period of 15 min was allowed at each potential level for the system to come to equilibrium, steps of 50 mV were used. Author

N70-33594# Naval Research Lab., Washington, D.C. Metal Physics Branch.

SPECIFIC HEAT AND ELECTRICAL RESISTIVITY OF EXCHANGE-ENHANCED DILUTE Pt-Ni ALLOYS

C. A. Mackliet, A. I. Schindler, and D. J. Gillespie *In its* Rept. of NRL Progr. Apr. 1970 p 1–9 refs (See N70-33593 18-34)

Avail: CFSTI CSCL11/6

Specimen compositions were 1.0, 3.4, 7.7, and 12.8 at % Ni for the specific heat work and 0.67, 1.3, 2.0, 4.0 and 9.4 at % Ni for the resistivity work. The specific heat and resistivity data for each alloy are well fitted by given relations. The experimental results are used to evaluate current theories of localized spin fluctuation effects; qualitative agreement is good, although quantitative agreement is very limited. Author

N70-33643# National Bureau of Standards, Washington, D.C. Corrosion Section.

THE ROLE OF PASSIVE FILM GROWTH KINETICS AND PROPERTIES IN STRESS CORROSION SUSCEPTIBILITY

Technical Summary Report, 1 Mar. 1969–28 Feb. 1970

Jerome Kruger, Edward Escalante, and John R. Amborse 28 Feb. 1970 55 p refs

(Contract NAONR-18-69)

(AD-704882; NBS-10-191; TSR-1) Avail: CFSTI CSCL 11/6

The role of passivation kinetics, film ductility, and tarnish film formation in stress corrosion cracking were each examined in the following studies: (1) Ellipsometry measurements of film growth kinetics on iron have been made for two anions whose solution cause stress cracking of steel (nitrate and hydroxide) and two that do not (chloride and nitrite). (2) A technique has been developed to measure film ductility directly. This technique couples an ellipsometer with a tensile machine. Thin films on Ta show a ductility of 3-4% in the presence and absence of F(-), an ion thought to decrease ductility. (3) Pure copper forms tarnish films in cupric acetate and sulfate solutions. It is susceptible to stress corrosion cracking in cupric acetate solution. In the absence of stress, oxide forms all over the copper surface, while stress concentrates oxide formation at the grain boundaries. These experiments point ot a brittle-film rupture mechanism of stress cracking. Author (TAB)

N70-33645# Naval Research Lab., Washington, D.C.

REPORT OF NRL PROGRESS, JUNE 1970

Jun. 1970 45 p refs

Avail: CFSTI

Metallurgical research is reported and includes the following studies: (1) The role of iron in the fracture of irradiated pressure vessel steel was investigated and it was found that the fracture strength temperature profile can be closely predicted by assigning to the process zone size, the flow properties of polycrystalline iron. (2) Research to determine the effect of gaseous environments on the mechanical properties of metals resulted in a metallographic study which demonstrated that environmentally accelerated failure and crack propagation were related. A quantitative model was developed for the measurement of crack growth rates as a function of surface gas adsorption. D.L.G.

N70-33646# Naval Research Lab., Washington, D.C. Metallurgy Div.

ROLE OF IRON IN FRACTURE OF IRRADIATED PRESSURE VESSEL STEEL

J. M. Krafft and R. A. Gray, Jr. *In its* Rept. of NRL Progr. Jun. 1970 p 1–14 refs (See N70-33645 18-17)

Avail: CFSTI

In mild steels, a fluence of energetic neutrons accumulating 10 to the 19th power/sq cm results in a severe loss of tensile ductility. Since the true strain hardening rate vanishes, the uniform elongation is reduced to a fraction of its initial value. Yet the degradation of fracture toughness, K sub Ic is rather moderate. Reduced only by one half, the K sub Ic values retain distinctive sensitivities to temperature and to strain rate. Such behaviors, suggest that a local tensile instability mechanism may still control K sub Ic of the irradiated steel but that the bulk flow properties are not representative of local fracture processes. It is found, in fact, that the K sub Ic temperature profile can be closely predicted by assigning to the process zone size the flow properties of polycrystalline iron. The effects of irradiation, as well as of high strain rate, can be accounted for with temperature-independent increases in the yield strength of iron, of amounts identical to these effects in steel. The results suggest dominance of fracture processes by the matrix phase of the steel, pure iron, or ferrite. The formation of iron ligaments can be associated with a size scale of the process zone small enough to fit within the free path in ferrite between precipitate phase colonies. A primary assurance of pressure vessel safety, the K sub Ic transition in medium-strength steels may thus be attributed to the ductility transition of its pure-iron matrix. Author

N70-33647# Naval Research Lab., Washington, D.C. Thermostructural Materials Branch.

THE GAS ADSORPTION MODEL FOR CRACK PROPAGATION

M. R. Achter *In its* Rept. on NRL Progr. Jun. 1970 p 15–19 refs (See N70-33645 18-17)

Avail: CFSTI

Reactive gases can accelerate crack growth in metals in fatigue and creep rupture. A model is described capable of relating quantitatively the rates of crack propagation and surface adsorption of gas. Possible atomic mechanisms of separation processes at crack tips could account for the observations. Author

N70-33695# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
THE EFFECTS OF PROCESSING ON THE DIMENSIONAL STABILITY OF BERYLLIUM MIRRORS
R. E. Maringer Apr. 1970 13 p refs
(Contract F33615-69-C-1343)
(AD-705382; DMIC-M-248) Avail: CFSTI CSCL 20/6

The accumulated experience indicates that beryllium is not an ideally stable material. Recent research has resulted in a significant advance in the understanding of the reasons for this instability. It is the purpose of this memorandum to point out some of the reasons for this instability and to indicate methods to avoid it. Author (TAB)

N70-33697+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
PHYSICAL TESTS AND CHEMICAL ANALYSIS OF FORGED STEEL TUBES AND STEEL PLATES ACCORDING TO ASTM [TESTES FISICOS E QUIMICOS DE TUBOS E CHAPAS DE ACO DE CONFORMIDADE COM AS ESPECIFICACOES ASTM]
Yara M. Alessio 6 Nov. 1969 11 p In PORTUGUESE; ENGLISH summary
(TN-6911-388) Avail: CFSTI

The procedure, standards and specifications followed in testing and chemical analysis of forged steel tubes and steel plates are described. Results of the ASTM tests are included. Author

N70-33722# Lehigh Univ., Bethlehem, Pa.
ANALYSIS OF FLOW AND FRACTURE OF COMPOSITE MATERIALS DURING GROSS PLASTIC DEFORMATION Annual Progress Report, Jun. 1969–Jun. 1970
Betzalel Avitzur 31 Mar. 1970 11 p refs
(Contract AT(30-1)-4078)
(NYO-4078-1) Avail: CFSTI

The behavior of composite materials was studied along two parallel paths. A model composite subjected to tensile loading was analyzed. An experimental study was made of the flow and fracture of particles included in several steels. Author

N70-33723# Politecnico di Torino (Italy). Ist. di Tecnologia Meccanica.
WORK ON MACHINABILITY IN THE COOPERATIVE GROUP C OF CIRP AND OUTSIDE THIS GROUP
G. F. Micheletti 1969 55 p refs Presented at CIRP Ann. Assembly, Geneva, Sep. 1969
Avail: CFSTI

Factors affecting machinability and methods for determining a machinability index are investigated. Data on machinability of materials, including high strength aerospace alloys, are given. Cooperative research is reported on machinability and metal cutting undertaken by countries in Europe, the United Kingdom, Japan, and the United States. Difficulties in establishing machinability index include the following considerations: Machinability depends on the combination of tool and work material; the index varies according to the wear criterium used; and machinability depends on such factors as the shape and dimensions of the workpiece, cutting speed, and chip area. The approach in Europe is to use short run tests, but in the United States the trend is toward long run tests. It is felt that the progress in the machinability field is considerable and is characterized by theoretical and practical contributions, and by the cooperation among the laboratories. N.E.N.

N70-33741# Massachusetts Inst. of Tech., Cambridge. Casting and Solidification Section.
SOLIDIFICATION AND THERMO-MECHANICAL PROCESSING OF ALUMINUM INGOTS, JUNE 1968 - OCTOBER 1969
M. C. Flemings, A. J. Campagna, R. Mehrabian, A. Reti, and S. N. Singh Oct. 1969 129 p refs
(Contract DA-19-020-ORD-5706(A))
(AD-705666) Avail: CFSTI CSCL 11/6

Work is reported on five separate but related research activities on solidification and thermomechanical processing of aluminum ingots. Several of these are completed research activities; others are in progress. They deal with (1) solution treatment of cast Al-4.5% Cu alloy, (2) effect of solution treatment of mechanical properties and fracture behavior of Al-4.5% Cu alloy, (3) effect of thermo-mechanical processing on solution treatment of wrought Al-4.5% Cu alloy, (4) heat flow in unidirectional solidification, and (5) laboratory simulation of the negative cone of segregation. Author (TAB)

N70-33742# Watervliet Arsenal, N.Y.
CODEPOSITION OF SUSPENDED OXIDE PARTICLES IN THE ELECTRODEPOSITION OF NICKEL
G. R. Lakshminarayanan and Fritz K. Sautter Apr. 1970 31 p refs
(AD-705583; WVT-7024) Avail: CFSTI CSCL 11/6

The codeposition of oxides with metals from various electroplating baths is investigated from the viewpoint of basic particle charge, particle size and adsorption of ions on to the surface of these oxides. The incorporation of Al2O3 (AlonC) and TiO2 (P85) in nickel from nickel electrolytes is studied over a wide range of experimental conditions (current density, pH, temperature and addition of electrolytes) and the influence of these variables is discussed. Polarization studies have shown that in agitated electrolytes the presence of suspended oxide (AlonC) has little or no effect on the mechanism of the deposition of nickel. Author (TAB)

N70-33763# Politecnico di Torino (Italy). Ist. di Tecnologie Meccanica.
THE THEORY OF CRYSTAL DEFECTS AND METALWORKING BY REMOVAL OF CHIPS [LA TEORIA DEI DIFETTI CRISTALLINI E LA LAVORAZIONE DEI METALLI AD ASPORTAZIONE DI TRUCIOLO]
S. Calvo 12 Oct. 1968 19 p refs In ITALIAN Presented at the Natl. Conf. on Machine Tools, Milan, 10-12 Oct. 1968
(Rept-16) Avail: CFSTI

The influence on the behavior of metal and on metal working by various types of crystal defects are described. The types of defects with their properties are classified. The crystal changes in elastic and plastic deformation, and recovery are analyzed from a microscopic viewpoint. F.O.S.

N70-33783# Lehigh Univ., Bethlehem, Pa.
STRENGTH AND STRUCTURE IN CYCLICALLY TRANSFORMED Fe-Ni-C ALLOYS Annual Progress Report, Jun. 1969–Jun. 1970
Charles A. Apple and George Krauss 6 Mar. 1970 7 p refs
(Contract AT(30-1)-3992)
(NYO-3992-2) Avail: CFSTI

The assembly of a direct resistance heating unit is described and the heating rate effects and strength measurements are briefly discussed. The changes in the thermal transformation of an Fe-Ni-C martensite to austenite and the reverse transformation were determined, in particular the austenite start temperatures and austenite finish temperatures. A general trend was found for the start temperature to increase and the finish temperature to decrease as the heating rate is reduced. An electrolytic polishing technique and a chemical etching technique were developed to prepare tensile samples with a reduced cross section from heated wires, and samples were tested to insure the reliability of the methods. The amounts of martensite and austenite were determined by X-ray diffraction measurements. N.E.N.

N70-33928*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HIGH TEMPERATURE EQUATION OF STATE FOR

ALUMINUM
R. J. Naumann Washington Aug. 1970 18 p refs
(NASA-TN-D-5892) Avail: CFSTI CSCL 11F

An equation of state is developed for metallic elements that describes both the solid and liquid phase at very high temperatures and pressures. Computations are carried out for aluminum which are compared with experimental results obtained from shocking porus samples. Author

N70-33989# Naval Research Lab., Washington, D.C.
POSTIRRADIATION CHARPY-V AND DYNAMIC TEAR SHELF LEVEL PERFORMANCE OF 12-IN. THICK A533-B PLATES AND WELD METAL
J. R. Hawthorne Apr. 1970 12 p refs
(AD-706004; NRL-MR-2114) Avail: CFSTI CSCL 18/10

Charpy-V (Cv) and dynamic tear (DT) test comparisons at shelf level temperatures were developed for the irradiated condition of two 12-in.-thick A533-B steel plates and a submerged arc weld deposit. Materials for this investigation were provided by the U. S. Atomic Energy Commissions Heavy Section Steel Technology (HSST) Program. Individual plates were identified as HSST Plates Nos. 01 and 02; the weld prepared by Combustion Engineering was identified as weld 50. Low temperature (<300F, 149C) and elevated temperature (550F, 288C) irradiations were conducted. Fluences for the eight irradiation experiments ranged from 2 to 3 x 10 to the 19th power n/sq cm >1 MeV. Experimental results indicate that the percent reduction in C sub v shelf energy is comparable to the percent reduction in DT shelf energy/C sub v shelf energy ratio for an individual material are retained under irradiation. Observations are in agreement with recent findings for A543 and other A533 steel plates. Ratio retention would permit the derivation of an approximate postirradiation DT shelf energy from postirradiation C sub v shelf energy for fracture safety analyses. Author (TAB)

N70-34019# General Motors Research Labs., Warren, Mich. Materials and Structures Lab.
SHOCK PROPAGATION AND FRACTURE IN 6061-T6 ALUMINUM FROM WAVE PROFILE MEASUREMENTS
Interim Technical Report
William M. Isbell and Douglas R. Christman Apr. 1970 41 p refs
(Contract DASA01-68-C-0114)
(AD-705536; MSL-69-60; DASA-2419) Avail: CFSTI CSCL 11/6

The use of high-resolution, time-resolved measurements of rear surface velocity in shock loaded 6061-T6 aluminum is discussed as a means of studying spall fracture. The influence of stress pulse shape, material temperature, maximum compressive stress and degree of fracture on free surface motion is presented and correlated with maximum tensile stress at the spall plane. A summary of dynamic properties data (equation of state, elastic wave velocity, stress-strain-strain rate behavior, spall threshold) and a brief discussion on fracture in metals are also given. Author (TAB)

N70-34027*# Aerojet-General Corp., El Monte, Calif. Microwave Div.
MICROWAVE RADIOMETER DATA STUDY, PHASE 2 Final Technical Report, 7 Oct. 1969 - 15 May 1970
A. T. Edgerton Jun. 1970 98 p refs
(Contract NAS9-9363)
(NASA-CR-108561; Rept-1344R-2) Avail: CFSTI CSCL 20N

Techniques for removing atmospheric and antenna pattern effects from the multifrequency microwave radiometer system (MFPR) were studied. Equations, data flow, and experimental methods for removing atmospheric effects are included with data reduction procedures for correcting MFPR data for antenna pattern effects. Flight test results and correction procedures are discussed. F.O.S.

N70-34137# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
ELASTIC FATIGUE IN TITANIUM STUDIES BY SCANNING ELECTRON-MICROSCOPY
William A. Wood Apr. 1970 21 p refs
(Contract N00014-67-A-0214-0011)
(AD-705512; TR-2) Avail: CFSTI CSCL 11/6

A study by scanning electron-microscopy was made of the fatigue caused by nominally elastic amplitudes in a strain-aging metal (titanium) where minor impurities only suffice to confer a significant elastic range. These amplitudes produce point-extrusions, which are contrasted with the slip-zone extrusions produced by larger amplitudes starting plastic strain. These point extrusions apparently give rise to microcracks when they form a dense enough distribution. They seem to arise from a finer and more inherent structural fault than the coarse accidental faults to which elastic fatigue has previously been attributed. Author (TAB)

N70-34141# Watervliet Arsenal, N.Y.
OPTIMUM FATIGUE CRACK RESISTANCE
Joseph F. Throop and G. A. Miller (Bethlehem Steel Corp., Bethlehem, Pa.) Jan. 1970 33 p refs Presented at the ASTM Fatigue Symp. on Achievement of High Fatigue Resistance in Metals and Alloys, Atlantic City, Jun. 1969
(AD-701892; WVT-7008) Avail: CFSTI CSCL 11/6

An evaluation is made of the influence of mechanical properties on fatigue-crack growth rate. Data representing 4340 and modified 4330 steel show that for levels of the stress intensity factor K below about 40 ksi sq root of (in.) mechanical properties have little influence on growth rate. However, at higher K-levels both the product of Youngs modulus, yield strength and fracture toughness, and the product of Youngs modulus, tensile strength and true strain at fracture seem to be reasonable indices of crack growth resistance. For K-levels above 40 ksi sq root of (in.) minimum fatigue-crack growth rate is provided by tempering 4340 and modified 4330 at temperatures of about 1000 and 1100 F, respectively. Author (TAB)

N70-34150*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF THERMAL LOADING ON COMPOSITES WITH CONSTITUENTS OF DIFFERING THERMAL EXPANSION
Charles A. Hoffman Washington Aug. 1970 80 p refs
(NASA-TN-D-5926; E-4768) Avail: CFSTI CSCL 11F

Estimations have been made of elastic stresses and elastic-plastic stresses and strains which occur in laminate and in fiber composites. Calculated elastic tensile, compressive, and shear stresses for model tungsten-reinforced - 80 Ni+20Cr-matrix laminate composites and fiber composites exceeded probable strengths of the respective constituents for a heat or cool cycle between 80 deg and 2000 F. Elastic-plastic tensile and compressive stresses were less but calculated concurrent mechanical strain was sufficiently large to pose a thermal fatigue problem. Limited experimentation on tungsten-reinforced - 80Ni+20Cr-matrix laminate composites and on tungsten-reinforced - copper-matrix composites subjected to heat-cool cycles produced structural damage in most specimens in from 1 to 11 cycles. The minimum temperature was 80 F, and the maximum temperature was 2000 F for the laminate composite specimens and 1650 F for the fiber composite specimens. Author

N70-34151*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF A COBALT-BASE ALLOY, HS-31, MADE BY EXTRUSION OF PREALLOYED POWDERS
John C. Freche, Richard L. Ashbrook, and William J. Waters 1970 28 p refs Proposed for Presentation at Mater. Eng. Conf. Cleveland, 19-23 Oct. 1970; sponsored by Am. Soc. for Metals

(NASA-TM-X-52842; E-5770) Avail: CFSTI CSCL 11F

Bars extruded from prealloyed powders of HS-31 made by argon gas atomization were evaluated by tensile and stress-rupture tests in the as-extruded and heat-treated conditions. Significant improvements in tensile strength over the as-cast condition were obtained with the as-extruded powder product up to 1400 F (760 C), but lower strengths were observed in the 1500 F (816 C) to 1800 F (982 C) temperature range. Heat treatments involving temperatures above the solidus and 30,000 psi (207 MN/m2) pressure substantially increased the stress-rupture life of the extruded powder product over that of cast HS-31 at intermediate temperature (1200 F, 649 C) and resulted in comparable life at high (1800 F, 982 C) temperature. Author

N70-34154# Boeing Co., Renton, Wash. Commercial Airplane Div.

METALLURGICAL EVALUATION OF 7175-T736 AND 7175-T66 DIE FORGINGS

H. W. Schimmelbusch May 1970 147 p refs

(AD-705968; D6-24480) Avail: CFSTI CSCL 13/8

Die forging alloy 7075-T73 is presently widely employed in Boeing aircraft because of its excellent stress corrosion resistance, but its mechanical properties are about 14% lower than those for 7075-T6 material. Development work by Alcoa on forging alloy 7175 has led to tempers which combine the mechanical properties of 7075-T6 with a high degree of stress corrosion resistance. The Commercial Airplane Group has conducted a metallurgical evaluation on alloy 7175 in both the peak strength T66 temper and the stress corrosion resistant T736 temper. Mechanical, stress corrosion, fatigue, and fracture properties were investigated. The results show that 7175-T736 has excellent stress corrosion resistance with strength that is equivalent to 7075-T6. The T66 temper has even higher strength properties than 7075-T6 but was found to have a high degree of stress corrosion and exfoliation corrosion susceptibility. Author (TAB)

N70-34177# Defense Documentation Center, Alexandria, Va.

MECHANICAL PROPERTIES OF BERYLLIUM, VOLUME 1 Report Bibliography, Dec. 1960 – Nov. 1968

Feb. 1970 123 p refs

(AD-701800; DDC-TAS-70-9-1) Avail: CFSTI CSCL 11/6

The annotated bibliography comprises citations of unclassified reports dealing with the properties and metallurgy of beryllium and its applications. The information covers tests for such properties as ductility, hardness, deformation, heat resistance, failure, and fatigue. Applications of beryllium in airframes, brakes, fuel tanks, storage tanks and rocket cases are also discussed. Author (TAB)

N70-34191# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEVELOPMENT OF HIGH-TEMPERATURE TITANIUM ALLOY VT9

V. N. Neugodova Apr. 1970 25 p refs Transl. into ENGLISH from Titan v Promyshelennosti. Sbornik Statey. (USSR), 1961 p 185–202

(AD-705232; FTD-HT-23-171-70) Avail: CFSTI CSCL 11/6

The paper describes work, done in 1957-58, in the course of the development of the high-temperature (HT) Ti alloy currently termed BT9(VT9). The target requirements for the new alloy specified the development of a Ti alloy for forging billets and stamping blanks which at 500 degrees centigrade would have a 100-hr stress-rupture strength of not less than 55 kg/mm(superscript 2) and a 50-hr creep limit (with 0.2 percent residual strain) of not less than 30 kg/mm(superscript 2), and which would manifest satisfactory thermal stability and plasticity at room temperature. Author (TAB)

N70-34198*# TRW Equipment Labs., Cleveland, Ohio.

THERMAL CONTROL COATING DEVELOPMENT MATERIALS REPORT

J. J. Chase and E. C. Knuth, Jr. Oct. 1969 59 p refs (Contract NAS9-8247)

(NASA-CR-108566; ER-7369) Avail: CFSTI CSCL 11F

Thermal control coating requirements for the high temperature components of the Hypergolic Electrical Power System (HEPS) were studied. Two coatings were selected for development of coating procedures on the materials of construction (copper and Hastelloy X). Fe2TiO5 was selected, and work was done to test the suitability of Fe2TiO5 and CaTiO3 coatings for HEPS materials. DC92-007 was selected as the coating to be applied to low temperature components. Tests were run to add to known emissivity and absorptivity data. Author

N70-34332# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.

PHYSICAL AND MECHANICAL PROPERTIES OF REACTOR MATERIALS Final Progress Report

J. B. Conway and P. N. Flagella Washington AEC Dec. 1969 67 p refs Sponsored by AEC

(GEMP-727) Avail: CFSTI

The physical and mechanical properties of materials being considered for high-temperature reactor applications are summarized. Emphasis is placed on the creep-strain profile of Types 304 and 316 stainless steel. NSA

N70-34353# Atomics International, Canoga Park, Calif.

BIAXIAL CREEP AND STRESS RUPTURE OF WIRE WRAPPED CLADDING IN 1200 F SODIUM UNDER DELTA T CONDITIONS

J. H. Shively 15 Apr. 1970 44 p refs

(Contract AT(04-3)-701)

(AI-AEC-12944) Avail: CFSTI

The results of biaxial stress-rupture and creep data tests on 10 to 15% cold-worked Type 316 stainless steel are presented. The tests were performed at 1200 F, in sodium flowing at 8 ft/sec. A system Delta T of 50 F was induced, just ahead of the test section. The tubes were wrapped with 0.070-in. diameter stainless steel wires with a 12-in. pitch, arranged in a close-packed array and surrounded with a hexagonal stainless steel shroud tube. The purpose of the test was to study the mass transfer effects of flowing sodium, acting in concert with wire spacers, on the biaxial creep behavior of stainless steel cladding. Control tests without wires were made in static sodium. The stress-rupture life of wire-wrapped tubes in flowing sodium falls within the uncertainty band for tests made in static sodium on another lot of large diameter. Some failures were located under wires near the inlet, which may be explained by interactions of wires and cladding introduced during attachment of the wires to the tube end caps. The observed wire shortening was related to tube diametral strain. Self-welding of wires to tubes was also observed. These results are only preliminary, pending further examination of the tubes. Author (NSA)

N70-34500# Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.

MECHANISM FOR STRESS CORROSION CRACKING OF STAINLESS STEEL IN REACTOR SYSTEMS

R. S. Ondrejcin Dec. 1969 17 p refs

(Contract AT(07-2)-1)

(DP-1089) Avail: CFSTI

A mechanism for chloride stress corrosion cracking of type 304 stainless steel that has been sensitized, pickled, and dry ground was shown to involve the chloride-bearing alumina present in reactor moderator-coolant systems. Chloride is absorbed by the alumina during its formation on hot fuel cladding; iron, an impurity in the cladding, greatly enhances chloride absorption. Alumina spalls and is transported by the coolant to the stainless steel surfaces. Chloride is released from the alumina by the acidic reaction at anodic sites on the steel. The negative chloride ion is attracted

to the positive anodic site and initiates stress corrosion cracking. Cracking of susceptible stainless steel by this mechanism can be reduced by controlling coolant pH (pD) between 5.0 and 5.2 to prevent general release of chloride, and by avoiding addition of chlorides and chlorinated hydrocarbons to the reactor, and by blocking anodic sites by inhibitors or by changing the potential of the stainless steel. Author (NSA)

N70-34514# California Univ., Livermore. Lawrence Radiation Lab.
CVD TUNGSTEN AND TUNGSTEN-RHENIUM ALLOYS FOR STRUCTURAL APPLICATIONS. PART 3: RECENT DEVELOPMENTS
Frank J. Huegel and William R. Holman 12 Dec. 1969 22 p refs Presented at the 2d Intern. Conf. on Chem. Vapor Deposition, Los Angeles, 10-15 May 1970
(UCRL-71668; CONF-700510-1) Avail: CFSTI

Results obtained in a continuing program to develop CVD tungsten and tungsten–rhenium alloy structures with mechanical properties comparable to those of wrought products are presented. Data relating the effects of all the plating parameters on the deposition rate, deposit composition, topography, microstructure, and mechanical properties, together with effects of various heat treatments on the microstructure and properties, are reviewed. Developments in CVD equipment and techniques are also included. Author (NSA)

N70-34538# Addis Translations International, Woodside, Calif.
DEFORMATION OF BINARY ALLOYS OF URANIUM CONTAINING 0-20 AT PERCENT MO, 0-30 AT PERCENT NB AND 0-100 AT PERCENT ZR WHEN SUBJECTED TO CYLIC HEATING UP TO 600-900 DEG C
V. K. Grigorovich et al Livermore, Calif. Calif. Univ., Lawrence Radiation Lab. Mar. 1970 22 p refs Transl. into ENGLISH from the Russian Transl. for Calif. Univ., Lawrence Radiation Lab., Livermore
(UCRL-Trans-10453) Avail: CFSTI

The shape stability and tendency toward surface hummock formation on cyclic heating was studied for uranium alloys with molybdenum, niobium, and zirconium. It was found that the shape stability of specimens after cyclic heating increases as the content of the alloying additive is raised to 20 to 30 at. %. Near the upper temperature limits of the heating cycles the residual deformations are seen to increase. The shapes of the alloy specimens that undergo an alpha yields beta transformation are changed markedly. The alloys that pressure the gamma solid solution having isotropic cubic structure, are more stable to deformation than alloys having the anisotropic alpha-U structure or undergoing an alpha yields gamma transformation. At equal contents of the alloying additive the U–Mo alloys occupy the foremost position as regards the stability; they are followed by the U–Nb and U–Zr alloys in this order. The binary uranium alloys containing more than 10 at. % of Mo or 15 at. % of Nb proved to be practically stable to cyclic heating with upper temperature limits of 600 to 900 C. Author (NSA)

N70-34598# Oak Ridge National Lab., Tenn.
TENSILE PROPERTIES OF HASTELLOY N WELDED AFTER IRRADIATION
H. E. Mc Coy, R. W. Gunkel, and G. M. Slaughter Apr. 1970 24 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2858) Avail: CFSTI

Fusion welds affecting 75% of the cross section were made in small tensile samples (0.125 in. in diameter) of Hastelloy N irradiated to thermal fluences up to 9.4 × 10 to the 20th power neutrons/sq cm. All of the unirradiated samples and 67% of the irradiated samples were satisfactorily welded using a specialized technique developed for this program. Surface contamination was suspected to be the cause of the unsuccessful welds in the irradiated samples. The welded irradiated samples generally had as good tensile properties at 25 and 650 C as the irradiated base metal. The weld metal deformed appreciably at 650 C and made a significant contribution to the overall fracture strain. The fracture location in the irradiated samples tested at 650 C shifted from the weld metal to the base metal following the post-weld anneal of 8 hr at 870 C. The porosity which was observed near the fusion line of the irradiated samples probably results from transmuted helium bubbles, but this did not seem to affect the location of the fracture. Author (NSA)

N70-34599# MSA Research Corp., Evans City, Pa.
THE EFFECTS OF HIGH TEMPERATURE SODIUM AND HELIUM ENVIRONMENTS ON THE DESIGN PROPERTIES OF 304 AND 316 STAINLESS STEELS
L. H. Kirschler, R. H. Hiltz, and R. C. Andrews Mar. 1970 59 p refs
(Contract AT(11-1)-765)
(MSAR-70-38; XAC-720264) Avail: CFSTI

As primary candidates for cladding and structural alloys for LMFBR systems, Types 304 and 316 stainless-steel alloys were exposed and evaluated in related high temperature environments. The exposure excursions were helium, high oxygen–sodium and high carbon–sodium. The evaluated properties were tensile tests in air and creep-rupture tests in clean sodium. The tensile tests were at room temperature, at 1200 and at 1400 F. The creep-rupture tests were in clean dynamic sodium at 1200 F with 20 feet/second velocity. Tensile-test comparisons are made with United States Steel data as well as ASME allowable stresses. Creep-rupture properties are also compared with USS and ASME allowables. Relatively short-time data are extrapolated to 100,000 hours and these, along with post-test metallographical studies, are compared by means of charts. Author (NSA)

N70-34600# Rensselaer Polytechnic Inst., Troy, N.Y.
PRECIPITATION AND DISPERSION HARDENING IN MAGNESIUM BASE ALLOYS Annual Report
Norman S. Stoloff 1 Mar. 1970 20 p refs
(Contract AT(30-1)-3719)
(RPI-3719-7) Avail: CFSTI

Work on the Mg–Th–Zr alloy was extended to study the role of thermomechanical processing on particle distribution and mechanical properties. In addition, considerable effort was devoted to a study of deformation and fracture modes in hafnium. An electrothinning technique for hafnium was developed. Thermal-mechanical treatments show promise for increasing the strength of Mg–Th–Zr alloy HK31A. Author (NSA)

N70-34611# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
SHORT-TERM TENSILE AND LOW-CYCLE FATIGUE STUDIES OF INCOLOY 800
J. B. Conway Washington AEC Dec. 1969 44 p refs
(Contract AT(40-1)-2847)
(GEMP-732) Avail: CFSTI

Two grades of Incoloy 800 were tested for short-term and low-cycle fatigue behavior in air. Material was available in the form of mill-annealed bar stock and solution-annealed bar and plate stock. The mill-annealed bar stock (grade 1) was tested at 427, 538, and 593 C. The solution-annealed bar and plate stock (grade 2) was tested at 538, 649, 704, and 760 C. Strain rates were investigated at strain ranges to cover the range of 100 to 100,000 cycles to failure. Results are presented in graphic form. NSA

N70-34620# Texas A&M Univ., College Station. Coastal and Ocean Engineering Div.
GALVANIC CORROSION OF STRUCTURAL ALUMINUM

COUPLED WITH MILD STEEL IN A DILUTE SODIUM DICHROMATE ELECTROLYTE

Robert F. Ford, Jr. and Bob M. Gallaway Jan. 1970 56 p refs *Its* Sea Grant Publ. No. 206

(Grants NSF GH-26; NSF GH-59)

(PB-190656; COE-119) Avail: CFSTI CSCL 11F

The study was concerned with the corrosion rate of aluminum coupled with, and insulated from, a large mild-steel cathode in five different solutions including seawater, tap water, distilled water, and two inhibitor solutions. Aluminum cathodically protects steel when large cathode-to-anode area ratios exist. The corrosion rate of the aluminum anode may be reduced by more than two orders of magnitude by disconnecting the couple. The presence of an inhibitor increases the corrosion rate of the uncoupled aluminum by about 35 percent, but this disadvantage is more than offset by the reduced corrosion of the steel cathode, making the use of an inhibitor highly desirable. Author (USGRDR)

N70-34839# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.

EVALUATION OF PLASTIC FATIGUE PROPERTIES OF HEAT-RESISTANT ALLOYS

J. B. Conway Washington AEC Dec. 1969 72 p refs

(Contract AT(40-1)-2847)

(GEMP-740) Avail: CFSTI

Low-cycle fatigue tests were made on rod stock types 304, 316, and 348 stainless steels. The parameters affecting low-cycle fatigue life of metals and alloys at elevated temperatures were determined. Low-cycle fatigue data for use in the design of structural components of high-performance nuclear reactor systems are given. Tests were performed on AISI type 304 stainless steel rolled at 1180 C into 16 mm rods, annealed 1 hr at 1066 C, and water quenched. Sections were cut, straightened, stress relieved 30 min at 1010 C, and water quenched. Ladle chemistry by weight percent of type 316 was tabulated. Type 348 specimens were given the same sequence of treatments as type 304. Plastic fatigue properties were evaluated from 21 to 816 C. NSA

N70-34748*# Scientific Translation Service, Santa Barbara, Calif.

CORROSION OF REACTOR MATERIALS UNDER IRRADIATION

S. Nomura Washington NASA Jul. 1970 22 p refs Transl. into ENGLISH from Nippon Genshiryoku Gakkaishi (Tokyo), v. 11, no. 6, 1969 p 353–361

(Contract NASw-2035)

(NASA-TT-F-13093) Avail: CFSTI CSCL 11F

Corrosion of reactor materials under irradiation is reviewed and discussed. Included are discussions of radiation damage in metals, radiation damage in oxide films, and radiation effects on corrosion environment. Radiation damage on a metal surface stimulates the dissolution of the metal into an aqueous solution and reduces its electrode potential. Results of tests indicate that high temperature aqueous corrosion of Zr and ZY-2 is accelerated by damage in the metal substrate rather than on the surface oxide film. The effects of corrosion caused by damage in the oxide film is explained in terms of increases in density, in electronic conductivity, in diffusivity, and in surface chemical reactivity. Radiolysis of the aqueous environment also influences the corrosion of metal through changes in the electrochemical properties of the solution and of the metal electrode. Author

N70-34756 National Lending Library for Science and Technology, Boston Spa (England).

INFLUENCE OF HIGH DEGREES OF DEFORMATION ON THE STRUCTURE OF OFHC COPPER [UTICAJ VISOKIH STEPENADEFORMACUE NA STRUKTURU OFHC BAKRA]

V. Milenkovic et al Jun. 1970 9 p refs Transl. into ENGLISH from Tehnika (Belgrade), v. 22, no. 12, 1967 p 2088–2091

(NLL-RTS-5753) Avail: Natl. Lending Library, Boston Spa, Engl.; 16s or 3 NLL photocopy coupons

A comparative investigation of deformed structures, using the optical and electron microscope is reported. It is found that there is non-uniformity, at deformation up to 70%, in the accompanying structural changes, especially at high degrees of deformation. Copper was used for the experiments. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-33520# Boeing Scientific Research Labs., Seattle, Wash.

FUNDAMENTAL CONCEPTS OF COMPOSITE MATERIALS

R. L. Mc Cullough Apr. 1970 117 p refs

(AD-705639; D1-82-0970) Avail: CFSTI CSCL 11/4

Materials which are lighter, stiffer, and stronger than the traditional materials of construction can be obtained by combining high performance fibers with a binder phase. Such combinations result in systems rather than kinds of materials; in contrast to monolithic materials their properties can be varied through control of fiber orientation and concentration. This control of properties permits the tailoring of materials make-up to more efficiently match special requirements for specific applications. Rational methods have been developed to explain and predict the behavior of composite systems in terms of their materials properties can be more fully exploited. The fundamental concepts of the models employed for this purpose are reviewed in this work. Author (TAB)

N70-33638# Aberdeen Research and Development Center, Aberdeen Proving Ground, Md. Coating and Chemical Lab.

SYNTHESIS AND STUDY OF DICARBOXYLIC ACID ESTERS AS LOW HYGROSCOPIC BRAKE FLUID COMPONENTS Interim Report

Allan R. Brause and David W. Lipp Apr. 1970 15 p refs

(AD-705377; CCL-280; IR-3) Avail: CFSTI CSCL 11/8

The object of this work was to synthesize and study a series of diesters of dicarboxylic acids as potential components of low hygroscopic brake fluids. For this purpose 37 esters (mostly diesters and previously unreported) were prepared by a modified Fischer esterification process. They were subjected to screening tests. Although no single compound was entirely satisfactory several exhibited properties which may be desirable in blending. Initial studies were made on blends of those esters which showed promise. This work will continue. Basic conclusions were drawn on the effects of different functional groups on rubber compatibility, water tolerance, and viscosity. Author (TAB)

N70-33736# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE SELECTION AND TESTING OF OPTIMUM LUBRICANTS FOR LOW-SPEED, LOW-TEMPERATURE, AND UNSEALED FRICTION UNITS

D. T. Gayevik 30 Jan. 1970 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Neft i Gaz (Baku), no. 3, 1968 p 53–56

(AD-705254; FTD-HT-23-632-69) Avail: CFSTI CSCL 11/8

The purpose of the article was to investigate optimum lubricants for such parts as steering mechanisms, transmissions and other parts which are generally poorly protected from dirt and

water, the operating temperature of which generally does not exceed the ambient temperature by more than 2 percent centigrade. In the experiments the dependence of the duration of tests on the type and amount of lubricant, the temperature of the surrounding medium, the material and the state of the friction surfaces, specific loading, the rate of slippage, and the rate of rotation, were studied. Author (TAB)

N70-33745*# Emerson and Cuming, Inc., Canton, Mass. Dielectric Materials Div.
DEVELOPMENT OF INORGANIC NON-FLAMMABLE SPACECRAFT POTTING, ENCAPSULATING, AND CONFORMAL COATING COMPOUNDS Final Report
Scott H. Foster and Kennath H. Lothrop 1 Oct. 1969 138 p refs
(Contract NAS9-8749)
(NASA-CR-108492) Avail: CFSTI CSCL 11C

Four compounds, non-flammable in oxygen, were developed, two of which were potting compounds and two were coatings. Of the two potting compounds, one is completely inorganic, and the other about 80% inorganic. Glass microballoons were incorporated to make the products repairable and to reduce density. In both formulations, a volatile solvent was found necessary. Removal of the solvent by evaporation left a porous structure that required a sealer coat. Some of the electrical properties under conditions of high humidity did not meet the requirements of the work statement. It was felt that this was due to the porosity. A conformal coating based on a brominated polyester was developed which was not porous, but which was not as readily repairable as the potting compound. It passed the majority of the requirements. Author

N70-33747# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
CARBON COMPOSITE MATERIALS REPORT
L. M. Mc Laughlin and H. T. Kite 9 Feb. 1970 164 p refs Revised
(Contract W-7405-eng-26)
(Y-SB-10-Rev-1) Avail: CFSTI

Research on the preparation and mechanical properties of carbon composites is reported. The materials include glassy carbon, carbon foam, graphite tape, porous carbon, specialty graphite, carbon honeycomb, and various pitches, phenolic resins, furans, and cements. N.E.N.

N70-33769*# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF THE KINETICS OF CRYSTALLIZATION OF SEVERAL HIGH TEMPERATURE GLASS SYSTEMS Quarterly Status Report
J. F. Bacon 1 Jun. 1970 36 p ref
(Contract NASw-2013)
(NASA-110767; J910939-2; QSR-2) Avail: CFSTI CSCL 11B

Intensive investigation of glass fibers drawn from a certain glass composition has shown that such fibers can be readily and continuously drawn at high rates of speed and restarted at will. Over forty million feet of these fibers have been drawn through an orifice of 0.038 in. dia at orifice temperatures from 1260 C to 1310 C, with leads of molten glass from 3/8 in. to 1-1/2 in., and at winding speeds of 4000 to 8000 ft/min. The glass fibers processed under these conditions show excellent properties. Diameters vary from 0.2 to 0.4 mil for these fibers which have a Young's modulus of 18.6 million psi, a specific modulus of 157 million inches and strengths which in twenty-two consecutive measurements averaged 772,000 psi and ranged from 600,000 to 1,000,000 after extreme values were discarded. A limited evaluation of the UARL glass fibers in a resin matrix indicated a unidirectional longitudinal modulus as high as twelve million psi, shear strengths as high as 16,000 psi, and tensile strengths (unsized) of 270,000 psi. Author

N70-33822# Toulouse Univ. (France). Faculte des Sciences.
VARIATIONS WITH TEMPERATURE OF THE ELECTRIC CONDUCTIVITY (NATURAL AND UNDER RADIATION) OF DIELECTRIC LIQUIDS. APPLICATION TO THE MEASUREMENT OF THE ACTIVATION ENERGY BOUND TO THIS CONDITION [VARIATION AVEC LA TEMPERATURE DE LA CONDUCTIBILITE ELECTRIQUE (NATURELLE ET SOUS RAYONNEMENT) DES LIQUIDES DIELECTRIQUES. APPLICATION A LA MESURE DE L'ENERGIE D'ACTIVATION LIEE A CETTE CONDUCTION]
Rene Delard (Ph.D. Thesis) 13 Dec. 1967 85 p refs In FRENCH
(NP-18105) Avail: AEC Depository Libraries

It was found that each liquid dielectric possesses an activation energy suitable for its intrinsic current as well as for its ionization current. The effects of temperature, important to the intrinsic current or on the background noise of the dosimeters, is clearly weaker on the ionization current. The role of impurities and of some traces of moisture in the natural and induced condition of liquid dielectrics was also found. In contrast, the activation energy of the induced current is constant when the conductivity of the liquid is above 10 to the 17th power ohms cm for 25 kV/cm. If the activation energy varies with the electric field, it also varies with the length of the carbon chains; also, the substitution of certain hydrogen atoms by radicals modifies this value. CCl4 has an exceptionally low activation energy. It is mixed with other liquid dielectrics, it behaves as an ionization inhibitor. The determination of the values for activation energy permits the preparation of some detectors possessing a weak coefficient of temperature. Author (NSA)

N70-33949# Nebraska Univ., Lincoln. Water Resources Research Inst.
SURFACE PROPERTIES OF TEFLON FILM IN SALINE WATER PROCESSES Final Report
Luh C. Tao, Richard Myers, and Dennis Kos 24 Jan. 1969 26 p refs Sponsored by Dept. of the Interior
(PB-189403; W70-03646) Avail: CFSTI CSCL 07A

Desalination evaporator scaling was considerably reduced by a thin polyfluorocarbon coating on boiler tubes. Coatings of McLube, made by McGee Chemical Company, less than 0.001-inch thick improved the heat transfer rate about 70% to 130% relative to the uncoated tubes. The initial small boiler was then modified in order to allow continuous feed of calcium sulfate solutions. The coating performance exhibited more improvement with (1) moderate feed rates of salt solution and (2) high temperature difference across the tube wall. The results from the small boiler were confirmed in a larger pilot scale boiler. The feasibility of using a low-adhesion coating to reduce scaling on evaporators has been established. Further study on durability of coatings and possible combination with seeding the feed solution is recommended. USGRDR

N70-33982*# Grace (W. R.) and Co., Clarksville, Md.
DEVELOPMENT OF INORGANIC NONFLAMMABLE VERMICULITE FLIGHT PAPER, PHASE 1 Technical Report, Feb.–Jul. 1968
E. W. Lard [1969] 20 p
(Contract NAS9-7782)
(NASA-CR-108447) Avail: CFSTI CSCL 11L

An inorganic paper has been developed from vermiculite plus chrysotile asbestos and Beta glass fibers which is nonflammable in 100% oxygen (16.5 psia), and accepts printing well by the offset process. Although not all properties of this new Vermiculite Flight Paper are equivalent to those of bond paper, nevertheless, the paper has considerable promise for many manned space flight missions. Author

N70-34022# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF THE DISPERSION OF OILS IN AIR ON

THE SEIZURE AND PITTING OF HARDENED STEEL
M. D. Bezborodko et al 13 Mar. 1970 20 p refs Transl. into ENGLISH from Trenie i Iznos v Mashinakh, Akad. Nauk SSSR, Inst. Mashinoved., SB (Moscow), no. 20, 1968 p 211–222
(AD-705764; FTD-MT-24-439-69) Avail: CFSTI CSCL 11/8

There are now many modifications of various friction machines used for the study of the lubricating capacities of oils intended for operation in conditions of high contact loads. To a lesser degree these machines are used for the study of antipitting properties of oils. The known friction machines make possible broad changes in oil testing conditions. However, no machine makes it possible to imitate the input of oil to friction zones as drops in an air medium or as fog. The authors have developed a test method to meet such a need. The basis of the test machine used is a four-ball friction unit installed in a reducer. The dispersion of oils due to ease of oxygen access to friction zones leads to an improvement of the anti-seizing characteristics of the oil. Dispersion of oils which do not contain anti-seizing admixtures has a negative effect on their anti-seizing properties. Other results are presented and discussed. Author (TAB)

N70-34034# Naval Civil Engineering Lab., Port Hueneme, Calif.
WATER PERMEABILITY OF COATING FILMS USING A RADIOISOTOPE TRACER TECHNIQUE Final Report, Jul. 1968–Jun. 1969
Eddy S. Matsui Apr. 1970 36 p refs
(AD-705988; NCEL-TR-674) Avail: CFSTI CSCL 11/3

The report deals with the development of an accurate and rapid method of determining moisture permeability through protective coatings using radiochemical techniques. It demonstrates that the radiochemical method, as compared to the ASTM Standard Method, is precise, sensitive and rapid. This method has been used to analyze variables which may have a significant effect on the moisture permeability of paint films. The variables analyzed include film thickness, vapor pressure, temperature, generic type of vehicle, type of pigment concentration, and moisture diffusion in liquid or vapor form. Author (TAB)

N70-34148*# Little (Arthur D.), Inc., Cambridge, Mass.
A FLAME RESISTANT SILICONE RUBBER Final Report, 1 Jun. 1969–1 Jun. 1970
J. Milgrom, J. T. Howarth, and S. G. Sheth Jul. 1970 99 p
(Contract NAS9-9510)
(NASA-CR-108568; ADL-71549) Avail: CFSTI CSCL 11J

The selection of the flame retardant was restricted to those additives that are stable under these conditions. Although the polymeric backbone of silicone rubbers is stable at elevated temperatures for an extended period, silicone rubbers are affected by the presence of slightly acidic or basic materials. In the screening of flame retardants, additives with a neutral pH that did not degrade to give residues that were either acidic or basic were selected. After the initial screening, two types of additives that were effective as flame retardants for silicone rubber were found: aluminum silicates and aromatic bromides. Author

N70-34214# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF THE VISCOSITY OF A LUBRICANT USED IN HYDRAULIC VIBRATION DAMPERS
V. Ye. Kopylov et al 26 Mar. 1970 9 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Neft i Gaz (Baku), v. 12, no. 1, 1969 p 33–35
(AD-705241; FTD-HT-23-178-70) Avail: CFSTI CSCL 11/8

In selection of the vibration dampers for a long column of drill pipe, the most acceptable chemical compound is considered as that with highest viscosity, V. Such a compound is nigrol, a transmission lubricant mixed with kanifol, a resin. Author (TAB)

N70-34217*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
NASA CONFERENCE ON MATERIALS FOR IMPROVED FIRE SAFETY
7 May 1970 128 p Conf. held at Houston, Tex., 6–7 May 1970
(NASA-TM-X-64330) Avail: CFSTI CSCL 11G

Short abstracts are provided of presentations given at the conference. Subjects covered included: (1) flammability requirements and test techniques; (2) materials development; (3) configuration control and materials applications; and (4) special tests. A.L.

N70-34239*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ROLLING-ELEMENT FATIGUE AND LUBRICATION WITH FLUORINATED POLYETHERS AT CRYOGENIC TEMPERATURES
Marshall W. Dietrich, Dennis P. Townsend, and Erwin V. Zaretsky [1970] 22 p refs To be presented at the Lubrication Conf., Cincinnati, 13–15 Oct. 1970; sponsored by the Am. Soc. of Mech. Engr. and the Am. Soc. of Lubrication Engr.
(NASA-TM-X-52863) Avail: CFSTI CSCL 11H

The lubrication characteristics of four fluorinated polyether lubricants in the temperature range of 160 to 410 R were investigated in a modified five-ball fatigue tester using SAE 52100 steel balls and compared with that of a super-refined mineral oil at room temperature. There was no statistical difference between the fatigue lives obtained with the fluorinated polyether fluid and the super-refined mineral oil at 305 R and 590 R, respectively. This result indicates that at lower temperatures with the polyether, no derating of SAE 52100 in fatigue is necessary. Elastohydrodynamic lubrication was obtained with the fluorinated polyether lubricants at outer-race temperatures from 160 to 410 R, even when outer-race temperatures were lower than the pour points of the fluids. The operating characteristics of the fluorinated polyether fluids at cryogenic temperatures compared favorably with those of the super-refined mineral oil at room temperature. Author

N70-34324# Defense Documentation Center, Alexandria, Va.
SEALS, VOLUME 1—A REPORT BIBLIOGRAPHY, JANUARY 1955–OCTOBER 1969
May 1970 181 p refs
(AD-706000; DDC-TAS-70-41-1) Avail: CFSTI CSCL 11/1

The annotated bibliography on Seals is topically arranged in alphabetical order. AD entries are divided into the following sections: fuel and gas seals, gaskets, glass seals, hermetic and hydraulic seals, metal seals, oil seals and o-rings, plastic and vacuum seals, rotary seals and rubber seals. Corporate author-monitoring agency, subject, title, personal author, and AD number indexes are included. Author (TAB)

N70-34329 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF INITIAL STAGES OF CRYSTALLIZATION OF LITHIUM ALUMINOSILICATE GLASSES USING THE MOESSBAUER EFFECT AND X-RAY ANALYSIS [IZUCHENIE NACHALNYKH STADII KRISTALLIZATSII LITIEVVALYUMOSILIKATNYKH STEKOL S PRIMENENIEM EFFEKTA MESSBANERA I RENTGENOFUZOVOGO ANALIZA]
Ya. A. Fedorovskii et al Apr. 1970 10 p refs Transl. into ENGLISH from Tr. Inst. Stekla (USSR), v. 129, no. 1, 1968 p 93–97
(NLL-RTS-5657) Avail: Natl. Lending Library, Boston Spa, Engl. 12s 6d or 2 NLL photocopy coupons

The role of nucleating agents during the formation of glass crystalline materials is considered. Common methods of investigating the crystallization of glasses associated with changes in their properties were found to be inadequate because of their low

sensitivity and the difficulties of obtaining a common interpretation from the results. The use of Mossbauer effect (or gamma resonance), on the other hand, was found to be particularly well suited to the investigation of the state of matter in the solid phase. The crystallization of lithium aluminosilicate glasses was studied by X-ray analysis and by measuring the Mossbauer spectra in heat treated glass specimens. Author

N70-34542 National Lending Library for Science and Technology, Boston Spa (England).
NEW FORMS OF DIAMOND: NOTES FROM MOSCOW, NO. 203
27 Feb. 1970 9 p Transl. into ENGLISH from Russian newspapers (NLL-Trans-203-(6167.650)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

A description of blast methods used for hardening diamonds is briefly compared with crystal methods. The discovery that diamonds can be obtained from methane at pressures less than one atmosphere is mentioned. S.S.

N70-34566# California Univ., Lawrence Radiation Lab.
POISSON'S RATIO FOR RIGID PLASTIC FOAMS
J. A. Rinde 19 Nov. 1969 23 p refs Presented at SPE 28th Ann. Tech. Conf., New York, 4-8 May 1970 Sponsored by AEC (UCRL-72092; CONF-700511-1) Avail: CFSTI

Poisson's ratio for several low-density plastic foams has been determined in both tension and compression. For polystyrene bead foams, and a polyurethane foam, Poisson's ratio is greater in tension than compression. In compression, Poisson's ratio is not linear, showing a larger value below the yield strain and a value near zero for high strains. For 0.05 and 0.10 g/cc polystyrene bead foam, Poisson's ratios are 1/3 in tensions and 1/4 in compression below the yield strain; at higher strains the value in compression is in the range 0.03 to 0.07. Author (NSA)

N70-34582*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DETERMINATION OF WATER-GLYCOL COOLANT FLAMMABILITY
Herschel H. Jamison Jun. 1967 18 p
(NASA-TM-X-64351; MSC-67-EP-10) Avail: CFSTI CSCL 11G

The flammability of the water-glycol coolant used on board the Apollo spacecraft was determined in order to ascertain to what extent, if any, this fluid constitutes a significant fire hazard under flight conditions. The secondary purpose was to determine the flammability limits of varying concentrations of water-glycol under a variety of temperature and pressure conditions and ith various ignition sources. The glycol concentration was varied between 35% and 100% glycol. These percentages cover the concentration of the CSM (ECS) glycol as well as the LM glycol. Other glycol concentrations were used in order to establish the flammability curve at various temperature, pressure and ignition source conditions. In all cases, pure oxygen was used as the environmental gas into which the water-glycol mist was sprayed. Author

N70-34640*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EVALUATION OF BROMOTRIFLUOROMETHANE AS A FIRE EXTINGUISHING AGENT FOR APOLLO HYPERGOLIC PROPELLANTS
Herschel H. Jamison 22 Nov. 1968 35 p refs
(NASA-TM-X-64349; MSC-EP-R-68-18) Avail: CFSTI CSCL 11G

Tests were conducted to determine the advisability of using Freon FE-1301 for fire extinguishment in the Apollo spacecraft lunar module adapter area. Test results indicate the following: (1) The flame from a mixture of A-50 fuel and N204 can be reduced and probably extinguished momentarily by copious quantities of liquid Freon FE-1301. (2) Polyuethane sponge and N204, though not hypergolic, will flame in air when ignited by an outside source and can be extinguished by Freon FE-1301. (3) Only under optimum conditions will a flame resulting from spontaneous ignition of polyurethane saturated with A-50 fuel in the presence of excess N204 be extinguished, even momentarily, by Freon FE-1301. (4) Liquid Freon FE-1301 does not ignite spontaneously in air at ambient conditions with aluminum alloy AA-2024 plate as a catalyst. The same results were obtained in mixtures of Freon FE-1301 with liquid A-50 fuel and with liquid N204. (5) Polyurethane sponge and A-50 fuel do not ignite spontaneously in air at ambient conditions with aluminum alloy AA-2024 plate as a catalyst. The same holds true for polyurethane sponge and N204. D.L.G.

N70-34685*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLEXIBLE MATERIAL HAVING A CONTROLLED RESILIENCY AND A PROCESS FOR PROVIDING SUCH MATERIAL Patent Application
Charles D. Baker, inventor (to NASA) Filed 31 Mar. 1970 13 p (Contract NAS7-100)
(NASA-Case-NPO-10853; US-Patent-Appl-SN-24149) Avail: CFSTI CSCL 11I

The material has predetermined elastic modulus established by mixing a given quantity of uncured fluidized elastomeric material, and a calculatable quantity of frangible glass spheres. This provides an homogeneous mixture of frangible spheres and fluidized elastomers, which is cured to a stabilized, compressive mass and, subsequently, compressed sufficiently to fracture and thus disintegrate the spheres. As a result, the cured mass is provided with a multiplicity of uniformly distributed voids, of a substantially common dimension, defined by resilient walls established as the spheres are disintegrated. These voids impart a predetermined stress/strain characteristic to the material whereby its resiliency accurately may be established. NASA

N70-34695*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MODIFIED POLYISOCYANURATE POLYMER FOAM Patent Application
Salvatore R. Riccitiello and John A. Parker, inventors (to NASA) Filed 4 May 1970 10 p
(NASA-Case-ARC-10280-1; US-Patent-Appl-SN-34553) Avail: CFSTI CSCL 11I

A polyisocyanurate polymer foam with superior fire resistant and mechanical properties is described. The foam is made by reacting a polymeric polyisocyanate with a polyether polyol comprising a condensation product of a multi-functional polyol and propylene oxide with grafted polyacrylonitrile branched side chains. The foam is resistant to high temperatures and has exceptional dimensional stability. NASA

N70-34703# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
MELTING POINT OF PURE ZIRCONIA
R. E. Latta, E. C. Duderstadt, and R. E. Fryxell Apr. 1970 5 p refs
(Contract AT(40-1)-2847)
(GEMP-735) Avail: CFSTI

Data are presented as the basis for assuming that the upper thermal arrest is indicative of the melting point of stoichiometric ZrO2. The value 2680 C is assigned an uncertainty of not greater than + or − 15 C. NSA

N70-34742*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IONENE MEMBRANE SEPARATOR Patent Application
Jovan Mosanin and Ho Yet Tom, inventors (to NASA) Filed 24

Sep. 1969 15 p
(Contract NAS7-100)
(NASA-Case-NPO-11091; US-Patent-Appl-SN-860781) Avail: CFSTI CSCL 11I

A water-insoluble, cationic, permselective membrane comprising a hydrocarbon, quaternary nitrogen-containing ionene polymer cross-linked to a polyvinyl alcohol substrate was prepared and described. This polyelectrolytic membrane is used as a battery separator. NASA

N70-34765# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
MELTING POINT AND PHASE TRANSFORMATION OF BERYLLIUM OXIDE
R. E. Latta, E. C. Duderstadt, and R. E. Fryxell Apr. 1970 4 p refs
(Contract AT(40-1)-2847)
(GEMP-736) Avail: CFSTI

Using a thermal arrest method, a melting point of 2430 + or − 10 C was obtained for BeO. In addition, the transformation was observed at 2095 C (heating) and 2058 C (cooling) during a single cycle. NSA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-33412# Technische Hogeschool, Eindhoven (Netherlands).
BOUNDARY PROPERTIES OF PENALTY FUNCTIONS FOR CONSTRAINED MINIMIZATION
Freerk Auke Lootsma 15 May 1970 111 p refs
Avail: CFSTI

A number of penalty-function techniques are considered for solving a constrained minimization or nonlinear programming problem. The techniques are designed to take into account the constraints of a minimization problem or, since almost none of the problems arising in practice have interior minima, to approach the boundary of the constraint set in a specifically controlled manner. Penalty functions are classified according to their behavior in the neighborhood of that boundary. Appropriate convexity and differentiability conditions are imposed on the problem under consideration. Furthermore, certain uniqueness conditions involving the Jacobian matrix of the Kuhn-Tucker relations are satisfied by assumption. The condition number of the principal Hessian matrix of a penalty function is studied and is found to vary with the inverse of the controlling parameter, independent of the behavior of the mixed penalty function at the boundary of the constraint set. The computational advantages and disadvantages of the penalty-function techniques treated in the monograph are discussed. An ALGOL 60 procedure for constrained minimization via a mixed parametric first-order penalty function is given as an example. Author

N70-33421# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
ON THE PARALLELISM BETWEEN STABILITY OF FINITE DIFFERENCE SCHEMES FOR INITIAL VALUE PROBLEMS AND CONVERGENCE OF ITERATIVE METHODS FOR LINEAR SYSTEMS
A. Taroni 14 Apr. 1969 27 p refs
(RT/FIMA(69)4) Avail: CFSTI

Finite difference schemes for the solution of general initial value problems, in at least one space dimension, are first considered and the basic definitions of consistency, convergence and stability are given in accordance with Lax-Richtmyer's theory. The general convergence condition of iterative methods for the solution of algebraic linear systems of equations is examined. The similarity between such a condition and the stability condition previously introduced is set out from a qualitative point of view. A quantitative analysis is worked out by means of an extension of Lax's equivalence theorem to the case of an infinite interval of time. Author

N70-33429# Stanford Univ., Calif. Dept. of Operations Research.
EXISTENCE OF X-PATHS IN ABSTRACT POLYTOPES
Ilan Adler, George Dantzig, and Katta Murty (Michigan Univ., Ann Arbor) Mar. 1970 8 p
(Contracts N00014-67-A-0112-0011; AT104-31-328; DAHC-04-67-0028; Grants NSF GP-9329; NIH GM-14789-02)
(AD-706017; SU-TR-70-1) Avail: CFSTI CSCL 12/2

Given a finite set E of n symbols a family S of subsets of E (called vertices) form an abstract polytope if (1) Each vertex is a subset of m symbols of E. (2) Every subset of m + 1 symbols of E contains either zero or two vertices (called adjacent). (3) Every pair of vertices V sup 0 and V sup * can be joined by a path V sup 0 = V sub 1, ..., V sub k = V sup * such that V sub i, V sub (i + 1) are adjacent and (V sub i) contained in (V sup 0) joined to (V sup *) i = 1, ..., k-1. It is shown that if two vertices of a given abstract polytope contain the same symbol (say x) then there exists a path such that every vertex along the path contains x. Author (TAB)

N70-33452# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
SOME REMARKS ON INFINITE VENEZIANO REPRESENTATIONS
S. Ferrara and A. F. Grillo 23 Dec. 1969 6 p refs *Its* Nota Interna No. 461
(LNF-69/79) Avail: CFSTI

Properties of a class of integral representations describing dual resonance models, which preserve all physical properties of the original Veneziano amplitude, to a series of satellite terms are investigated. Author

N70-33471# Naval Postgraduate School, Monterey, Calif.
THE FINAL VALUE METHOD OF APPROXIMATING THE SOLUTION TO NONLINEAR DIFFERENTIAL EQUATIONS WHICH ARE CONSTANT IN THE STEADY STATE
Vincent Edward O'Neill (M.S. Thesis) Dec. 1969 50 p refs
(AD-706029) Avail: CFSTI CSCL 12/1

The analysis of non-linear systems has frequently been a major problem to the engineer. The solution of system equations often requires either a computer or relatively complex numerical techniques. A straight-forward, relatively simple method is proposed herein which permits the engineer to satisfactorily approximate the exact solution to certain non-linear differential equations. Author (TAB)

N70-33499# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
A TEST ON THE INTENSITY (HAZARD RATE) OF A POISSON PROCESS
J. G. Saw Feb. 1970 16 p
(Contract DAHC04-68-C-0002; Proj. Themis)
(AD-705647; THEMIS-UF-TR-33; AROD-T-1-48-RT) Avail: CFSTI CSCL 12/1

Given the realization of a poisson process of intensity lambda (u) over the interval of time (0,t), it may be required to distinguish between two alternative hypotheses, H1: that lambda (u) is a

decreasing function over (O,t) versus H2: that lambda (u) is an increasing function over (O,t). A test criterion is proposed and the unbiassedness of the criterion is demonstrated. Author (TAB)

N70-33543# Stanford Univ., Calif. Operations Research House.
SCHEDULING PROBLEMS WITH INTERVAL DISJUNCTIONS
Bernard G. Sussmann Mar. 1970 44 p refs
(Contracts N00014-67-A-0112-0011; DAHC04-67-C-0028; AT(04-3)-326; Grants NSF GP-9329; NIH GM-14789-02)
(AD-706021; SU-TR-70-5) Avail: CFSTI CSCL 12/2

Interval disjunctions arise in scheduling problems when the durations of some jobs are constrained not to overlap. Such situations are found in production scheduling, project scheduling, traffic light scheduling, etc. A general class of deterministic scheduling problems with interval disjunctions is defined in the paper. The structure of its solution set is studied in connection with the theory of potentials on a graph. A branch-and-bound algorithm is described for the case where the objective function is to minimize the total duration; optimal and heuristic variants of the algorithm are discussed. Author (TAB)

N70-33596# Boeing Scientific Research Labs., Seattle, Wash.
RANDOM VARIABLES WITH INDEPENDENT BINARY DIGITS
George Marsaglia Jan. 1970 15 p refs *Its* Mathematical Note 641
(AD-705642; D1-82-0955) Avail: CFSTI CSCL 12/1

A discussion is presented concerning a random variable with independent binary digits having specific values and probabilities. Proofs are given for the random variable to have a density function, a continuous density function, and a singular distribution. Author

N70-33609# Stanford Univ., Calif. Dept. of Computer Science.
ALGORITHMS FOR MATRIX MULTIPLICATION
R.P. Brent Mar. 1970 57 p refs Sponsored in part by AEC
(Contract N00014-67-A-0112-0029; Grant NSF GJ-798)
(AD-705509; SU-CS-70-157) Avail: CFSTI CSCL 12/1

Strassens and Winograds algorithms for matrix multiplication are investigated and compared with the normal algorithm. Floating - point error bounds are obtained, and it is shown that scaling is essential for numerical accuracy using Winograds method. In practical cases Winograds method appears to be slightly faster than the other two methods, but the gain is, at most, about 20%. An attempt to generalize Strassens method is described. Author (TAB)

N70-33615# Naval Postgraduate School, Monterey, Calif.
ON THE DISTRIBUTION THEORY FOR SOME CONSTRAINED LIFE TESTING EXPERIMENTS
Stuart Lowe Tenney (M.S. Thesis) Oct. 1969 52 p refs
(AD-706062) Avail: CFSTI CSCL 12/1

Various aspects of reliability test programs when the number of items to be tested equals or exceeds the number of test chambers available for testing and when the underlying failure distribution is exponential are studied. Specifically, two bivariate processes are formed and characterized: (i) the time until the rth failure and the accumulated test time of the first r failures and (ii) the number of failures in the time interval (O, T) and the total test time accumulated in (O, T). These are treated in the two cases: replacement and nonreplacement. Relations which exist between contractual specifications for reliability demonstration and the underlying distributions of the test program are discussed. Maximum likelihood estimators are developed for the distributions when necessary. Author (TAB)

N70-33621# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF THE UTILITY OF LAPLACE TRANSFORMS FOR NON-LINEAR DIFFERENTIAL EQUATIONS
Walter Thomas Chwatek (M.S. Thesis) Dec. 1969 39 p refs
(AD-706006) Avail: CFSTI CSCL 12/1

The use of Laplace Transforms has long been one of the primary methods used in solving linear differential equations but recently the extension and application of this method to the solution of basic non-linear systems has been proposed. This latter technique is presented and expanded to include various non-linear functions. The applicability of this method to systems of varied form and complexity is then explored and the validity of the derived solution investigated. Author (TAB)

N70-33641# Stanford Univ., Calif. Dept. of Operations Research.
MATRIX-THEORETIC CRITERIA FOR THE QUASI-CONVEXITY AND PSEUDO-CONVEXITY OF QUADRATIC FUNCTIONS
Richard W. Cottle and Jacques A. Ferland Apr. 1970 23 p refs
(Contracts N00014-67-A-0112-0011; AT(04-3)-326; Grant NSF GP-9329)
(AD-706022; SU-TR-70-6) Avail: CFSTI CSCL 12/2

It is well known that quasi-convexity and pseudo-convexity play a natural role in nonlinear programming theory. Despite this, it is said that these notions lack utility because they have defining conditions involving infinitely many inequalities and are not easily checked. The aim of the paper is to prove that testing the quasi-convexity (pseudo-convexity) of a quadratic function on the nonnegative (semipositive) orthant can be reduced to an examination of finitely many conditions. TAB

N70-33660*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
NUMERICAL DEFINITION OF LOCALIZED FUNCTIONS ON A SPHERE
K. Hebb and S. G. Mair *In its* Possible Geopotential Improvement from Satelite Altimetry 10 Feb. 1969 p 47-98 (See N70-33658 18-19)
Avail: CFSTI CSCL 12 A

A mathematical discussion is given on localized functions of a sphere, and a series of checks for the validity of coefficients is introduced. Printouts are shown for coefficients of the expression. J.A.M.

N70-33667# Naval Postgraduate School, Monterey, Calif.
DESIGN OF CONSTRAINED OPTIMAL CONTROLS FOR LINEAR REGULATORS WITH INCOMPLETE STATE FEEDBACK
Ergin Ozer (M.S. Thesis) Oct. 1969 66 p refs
(AD-706013) Avail: CFSTI CSCL 12/1

The need for an auxiliary performance measure for the design of constrained optimal controls for linear regulators is shown. Several auxiliary performance measures are compared, and the maximum of the absolute degradation over the admissible initial states is selected as the auxiliary performance measure. Computational algorithms which make extensive use of existing library subprograms are developed for the design of constrained optimal controls in those cases where the control vector is specified as constant or piecewise-constant linear feedback of the output vector. Numerical examples including a third-order system and a time-varying system are given to illustrate the applications of the proposed algorithms. Author (TAB)

N70-33669# Army Missile Command, Redstone Arsenal, Ala. Future Missile Systems Div.
POWER RATES OF SIMULTANEOUS TESTS FOR

VARIANCES
Charles E. Colvin 10 Feb. 1970 88 p refs
(AD-705591; RF-TR-70-1) Avail: CFSTI CSCL 12/1

The report investigates the behavior of power rates associated with simultaneous tests for the variances of a bivariate normal distribution such that separate conclusions can be drawn about each parameter. The power rate is defined as the probability that one or both hypotheses are rejected when either one, or both, are not true. Alternate hypotheses were investigated when both hypotheses have either (i) two-sided, (ii) one-sided upper, or (iii) one-sided lower alternatives. Author (TAB)

N70-33676# California Univ., Berkeley. Center for Research in Management Science.
DECISION RULES FOR REACTING TO NOISY SIGNALS FROM A WARNING SYSTEM Technical Report, Sep. 1967 - Sep. 1969
T. Y. Hans Tjian Feb. 1970 89 p refs
(Contract N00014-69-A-0200-1011)
(AD-705522; TR-31) Avail: CFSTI CSCL 12/2

Using the minimization of total expected discounted cost as the criterion for optimality, this study investigated via dynamic programming, a class of stochastic sequential decision problems known as warning problems. Specifically, the study investigates two types of warning systems (Type I and Type II) with single and multiple signals. The dynamic programming models of Type I for single and multiple signals yielded a critical waiting time rule (CWT) as well as a critical probability value (CPV) rule as an optimal decision rule. However, for Type II, with two signals, the optimal rule is a CPV rule, but the corresponding waiting time rule, in general, is shown a CWT rule. Author (TAB)

N70-33685# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
COMPARISON OF SOME MULTIGROUP STATIONARY DIFFUSION CODES [CONFRONTO FRA ALCUNI CODICI DI DIFFUSIONE STAZIONARIA A MOLTI GRUPPI]
E. Bittoni and S. Giambuzzi 21 Mar. 1969 36 p refs In ITALIAN
(RT/FIMA(69)2) Avail: CFSTI

A comparison of diffusion codes which could be substituted for PDQ-2 is presented. Codes considered are ALCI-1, EXTERMINATOR, CRAM, and SQUID 2Pi. A brief description of the methods used in solving the equations of diffusion for each code is given, and tabulated comparisons are included. Transl. by F.O.S.

N70-33689# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
STUDIES ON GAME COMBINATIONS [UNTERSUCHUNGEN UEBER KOMBINATORISCHE SPIELE]
Thomas Stroehlein (Ph.D. Thesis) 1970 68 p refs In GERMAN
Avail: CFSTI

Considered are alternating gain-loss games with perfect information that can be proven by strategy. Winning strategic properties are determined through construction of winning formulas in Boolean matrix algebra and by correlating global-optimal strategic characteristics with local-optimal conditions. Solutions to the assigned Boolean equation system for a game and the existence of a kernel establish the fact that a cyclic bipartite graph possesses two kernels whose mean can be contained in other kernels but which must be contained in their summation. An algorithm is formulated for chess end games and proved winning for the queen party in a queen-castle end game of not less than 31 moves. Transl. by G.G.

N70-33721*# Mathematical Research, Inc., Houston, Tex.
THE METHOD OF MOMENTS
[1969] 86 p refs
(Contract NAS9-6964)
(NASA-CR-108498) Avail: CFSTI CSCL 12A

A detailed analysis of a special case in approximation theory known as the method of moments is presented. The method of moments is described and it is shown how it can be used to solve the eigenvalue problem and problems of the first and second kind in a finite dimensional space. When the operator in question is completely continuous certain stronger results are obtained. These relate to problem solutions as well as convergence theorems. In addition it is shown how this method can be used to speed convergence in the classical Liouville-Neumann method of successive approximation. Results are given for self-adjoint operators in which case certain of the algorithms can be simplified. Various types of problems frequently encountered are discussed, and certain time dependent problems and problems with unbounded operators are considered. Necessary steps to apply the results of each algorithm are summarized. Author

N70-33765# Electromagnetic Research Corp., College Park, Md.
RADIATION FROM SLOT ANTENNAS ON CONES IN THE PRESENCE OF A LAYERED PLASMA SHEATH Final Report
M. Katzin and W. B. Johns, Jr. Jan. 1970 82 p refs
(Contract DAAG39-67-C-0036)
(AD-705565; HDL-0036-1) Avail: CFSTI CSCL 9/5

The radiation from slot antennas on a cone in the presence of an inhomogeneous sheath is treated. The sheath is considered as being made up of one or two conical layers, each of which is homogeneous. The boundary conditions lead to a system of integral equations, which number 4M + 4 for a sheath composed of M(=1 or 2) conical layers. These are reduced to singular integral equations of Cauchy type, which are solved in iterative fashion. For sufficiently fine stratification of the sheath, the first iteration should suffice. In general, fields of both magnetic and electric types are generated in the presence of a sheath, even though only a field of magnetic type may be generated in free space. For a ring slot, however, in which the excitation is azimuthally symmetrical, only a field of magnetic type is generated even in the presence of a sheath. It is shown that the solution for this case forms the basis of the solution for the general case. The far field is found by a multidimensional saddle point evaluation. This is illustrated in detail for the free-space case, and then the far field patterns in the presence of a sheath are determined. This can be carried out successfully for all components, and to arbitrary orders of iteration. Author (TAB)

N70-33786*# National Aeronautics and Space Administration, Washington, D.C.
TABLES OF CHARACTERISTIC EXPONENTS OF MATHIEU EQUATIONS
T. D. Kuznetsova et al May 1970 77 p refs Transl. into ENGLISH from the publ. 'Tablitsy Kharakteristicheskikh Pokazateley Dlya Uravneniy Mate' Moscow, Computer Center, Acad. of Sc. USSR, 1969 p 1-69
(NASA-TT-F-12985) Avail: CFSTI CSCL 12A

Tables of the characteristic exponents of Mathieu equations are presented. Values of the characteristic exponent for the Mathieu equation specified were calculated in the interval $0 \leq q \leq 15.9$ and $0.1 \leq q \leq 19.8$ with steps of 0.1 for a and q. Author

N70-33790*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
RELIABILITY TESTING AND DEMONSTRATION SESSION 3-B
Vincent Lalli 1969 19 p refs Presented at 7th Ann. Reliability Eng. and Management Inst., Tucson, Ariz., 3-12 Nov. 1969 sponsored by Arizona Univ.
(NASA-TM-X-52682) Avail: CFSTI CSCL 12A

Applications of statistical methods covered in the Reliability

Testing and Demonstration Lectures include confidence limits for normal, lognormal, and bionomial functions. Emphasis centers on failure and failure rate, reliability, and hazard rate. E.M.C.

N70-33792*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

GENHYP: A FORTRAN 5 PROGRAM FOR GENERAL LINEAR HYPOTHESIS TESTING

Fred C. Delaney and Fred N. Speed May 1970 55 p refs
(Contract NAS9-5384)
(NASA-CR-108499) Avail: CFSTI CSCL 12A

GENHYP is a general, linear, hypothesis-testing program which computes sum-of-squares for linear models with or without missing cells and for the balanced or unbalanced case. It is easy to use and will compute sum-of-squares for linear models of the form, $Y = Xu + e$, subject to theta to the $T(u) = 0$ where the usual assumptions are made about e. The program is described and numerical examples of various linear models are included in an effort to simplify usage of the program. Author

N70-33816# Oak Ridge National Lab., Tenn. Health Physics Div.

TESTING THE UNIFORMITY OF VARIANCE IN ARITHMETIC AND LOGARITHMIC UNITS OF A Y-VARIABLE FOR CLASSES OF AN X-VARIABLE

G. L. Baskerville Apr. 1970 38 p refs
(Contract W-7405-eng-26)
(ORNL-IBP-70-1) Avail: CFSTI

A FORTRAN IV computer program was designed to aid users judgment of the homogeneity of variance around regressions for data untransformed and transformed by logarithms, as in allometric relations of organism mass on diameter and/or height (length). A great majority of tests on such relations are shown elsewhere to favor log-log transformation. Therefore it is important that regressions based on the logarithms be applied to data with an appropriate correction (included here) to avoid bias, which commonly tends to underestimate the expected value of the untransformed value of Y for a given value of X. This would underestimate sums of many such values, e.g., for the total mass, growth, or chemical inventory of a forest stand. Program listing, description, output tables, and Calcomp plotted graphs should help lead the user through a series of decisions about data analysis which is natural and statistically useful for this and other inferences which recur many times in analysis of productivity data for the International Biological Program. Author

N70-33817# Iowa State Univ. of Science and Technology, Ames.

CONFORMAL MAPPING OF STEPPED SURFACES

G. J. Jones Jan. 1970 42 p refs
(Contract W-7405-eng-82)
(IS-2254) Avail: CFSTI

The simplification of two dimensional potential problems in difficult geometries by means of the Schwartz-Christoffel conformal transformation is discussed. The particular case of problems in which a boundary contains one or more steps is considered and the well known solution for the single step is reviewed. The general case of an n-step train is then investigated and the necessary equations are derived. The problems involving two and three steps are considered in detail and the parameters necessary to produce equiheight steps are given. Also included are sample digital computer programs and their results for two- and three-step surfaces. Author

N70-33821# Joint Publications Research Service, Washington, D.C.

OPTIMAL PROCESSES IN CONFLICT SITUATIONS

V. M. Gavrilov 29 Jun. 1970 158 p refs Transl. into ENGLISH from Russian report
(JPRS-50844) Avail: CFSTI

Optimization of processes occurring in a conflict situation, when the process is controlled by two opposing sides is considered. Continuous processes are described by ordinary differential equations, and discrete processes by difference equations. The optimality of a process is understood in the sense of the minimax or maximin functional of the process phase coordinates on the controlling parameters of the opposing sides in the case of strict competition, and in the sense of the maximum of the functional for each of the controlling sides in loose competition. The fundamental relationships for minimaxes and maximins in the selection of controlling parameters before the beginning of the process and during the course of the process are determined. The necessary conditions for optimality of the controlling parameters in the presence and in the absence of the saddle point or a situation of equilibrium in pure strategies are established also the presence of limitations on the phase coordinates and lagging arguments. Author

N70-33876# Stanford Univ., Calif. Dept. of Computer Science.

THE METHOD OF ODD/EVEN REDUCTION AND FACTORIZATION WITH APPLICATION TO POISSON'S EQUATION, PART 2

B. L. Buzbee (Los Alamos Sci. Lab.), G. H. Golub, and C. W. Nielson (Los Alamos Sci. Lab.) Mar. 1970 39 p ref
(Contract N00014-67-A-0112-0029; Grant NSF GJ-798)
(AD-705508; SU-CS-70-155; LA-4288) Avail: CFSTI CSCL 12/1

The methods of Buneman are derived and generalized for solving elliptic partial difference equations in a rectangular region. It is shown why the Buneman methods lead to numerically accurate solutions whereas the CORF algorithm may be numerically unstable. Several numerical examples are given and discussed. Author (TAB)

N70-33882# California Inst. of Tech., Pasadena.

DESIGNS DERIVED FROM PERMUTATION GROUPS

Marshall Hall, Jr., Richard Lane, and David Wales 1970 29 p refs
(Contract N00014-67-A-0094-0010)
(AD-705623) Avail: CFSTI CSCL 12/1

The following topics are discussed: Rank three permutation groups; Existence of a (56, 11, 2) design; Construction of the symmetric design with $v = 56$, $k = 11$, lambda = 2; Designs from the simple group of order 25920. TAB

N70-33894# Oregon State Univ., Corvallis. Dept. of Statistics.

CONSISTENT EMPIRICAL APPROXIMATION OF A-PRIORI DISTRIBUTIONS

Charles J. Phillips and Donald Guthrie Jun. 1969 51 p refs
(Grants NSF GP-6142; NSF GP-7491)
(TR-10) Avail: CFSTI

A mathematical discussion is presented on decision problems arising with a specified structure. Estimates are made of a priori distributions over compact subsets of the parameter space Lambda, and of discrete prior distributions with varying dimensional random vectors. E.M.C.

N70-33917# Purdue Univ., Lafayette, Ind. Krannert Graduate School of Industrial Administration.

QUADRATIC PROGRAMMING AND ESTIMATION PROBLEMS

E. Loehman, D. Pingry, and A. Whinston 1970 47 p refs
(Contract N00014-67-A-0226-0008)
(AD-705626) Avail: CFSTI CSCL 12/1

The purpose of the paper is to present various problems relating to multivariate regression in a unified fashion using the quadratic programming tableau. The topics considered are

multicollinearity and the generalized inverse, picking the best regression model, and constrained estimates and hypothesis testing for regression coefficients. TAB

N70-33924# Rocketdyne, Canoga Park, Calif.
ASYMPTOTIC DISTRIBUTIONS FOR SUMS OF INDEPENDENT EXPONENTIALLY DISTRIBUTED RANDOM VARIABLES AND FOR THE PURE BIRTH PROCESS Final Report
Bernard Sherman Wright-Patterson AFB, Ohio ARL Jan. 1970 16 p refs
(Contract AF 33(615)-2818)
(AD-705637; ARL-70-0014) Avail: CFSTI CSCL 12/1

The question of asymptotic distributions for the pure birth process is considered. For the Poisson process it is known that the state variable x(t), appropriately standardized, converges in distribution to the normal distribution. For the Yule-Furry process the asymptotic distribution is exponential. The Poisson and Yule-Furry processes are the special cases, corresponding to alpha = 0 and alpha = 1, of the pure birth process x(t) with parameters lambda sub k = lambda (k to the power alpha), k = or > 1, minus infinity < alpha = or < 1, lambda a positive constant. On the basis of heuristic reasoning used in this report it is concluded that for this more general pure birth process the asymptotic distribution of the appropriately standardized state variable x(t) is normal if alpha = or < 1/2 and non-normal if 1/2 < alpha = or < 1. TAB

N70-33928# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
MULTIPLE DECISION SELECTION AND RANKING PROCEDURES AND MULTIVARIATE DISTRIBUTION THEORY Final Report, Oct. 1966 - Nov. 1969
Shanti S. Gupta Wright-Patterson AFB, Ohio ARL Jan. 1970 25 p refs
(Contracts F33615-67-C-1244; AF 33(537)-11737)
(AD-705636; ARL-70-0012) Avail: CFSTI CSCL 12/1

Research on selection and ranking problems and multivariate distribution theory has been carried out on several aspects of the problem. The significant results obtained relate to univariate and multivariate populations using parametric as well as non-parametric procedures. Some work has been done in the area of sequential selection procedures under the subset selection formulation. Also a beginning has been made for selection from populations which are partially ordered in some sense with respect to a known population G. A few results have been obtained using a decision-theoretic approach to the problem of selection and ranking. Currently the attention is being focused on the construction of decision rules under certain optimality conditions. All these problems were examined under the subset selection formulation. Author (TAB)

N70-33976# Naval Research Lab., Washington, D.C.
FORTRAN PROGRAM FOR FAST FOURIER TRANSFORM
James R. Fisher 16 Apr. 1970 25 p refs
(AD-706003; NRL-7041) Avail: CFSTI CSCL 12/1

The recent development of algorithms for the rapid computation of Fourier transforms has reduced the computation time of this powerful analysis tool by orders of magnitude, enabling previously uneconomic procedures to become commonplace. In the report the fast Fourier transform (FFT) is derived from the basic equations and presented in matrix form as a means of illustrating the stage-by-stage reduction of the input data to Fourier coefficients by the algorithm. Based on this development a Fortran IV program is presented, including a full description of the statements, by relating it to the theoretical requirements. Thus a complete understanding of the FFT algorithm and program can be obtained, eliminating the constraints imposed by treating the FFT as a black box beyond the manipulative powers of the user. Author (TAB)

N70-33997*# Indiana Univ., Indianapolis.
ON THE RIGHT WEAK SOLUTION OF THE CAUCHY PROBLEM FOR A QUASILINEAR EQUATION OF FIRST ORDER Final Report
Eberhard Hopf 9 Jan. 1970 12 p refs
(Grant NGR-15-003-060)
(NASA-CR-109795) Avail: CFSTI CSCL 12A

Consider the quasilinear equation of first order u sub t + f(u) sub x = 0 with t, x, u being real scalars and f(u) being a given smooth function on (-infinity, infinity). Wanted is a solution u = u(t, x) , t > 0, that is prescribed for t = 0. The solution can be found by means of the classical method of characteristics. Author

N70-34059# Ohio State Univ. Research Foundation, Columbus.
VARIANCE-COMPONENT ESTIMATION FOR THE UNBALANCED ONE-WAY RANDOM CLASSIFICATION: A CRITIQUE
David A. Harville Wright-Patterson AFB, Ohio ARL Oct. 1969 81 p refs
(Contract F33615-67-C-1758)
(AD-700772; ARL-69-0180) Avail: CFSTI CSCL 12/1

The article provides a comprehensive and critical treatment of the problem of making point estimates of the variance components associated with the possibly-unbalanced one-way random classification. Both Bayesian and various non-Bayesian viewpoints are covered. The effects of relaxing the assumptions ordinarily imposed on the model are considered. Author (TAB)

N70-34071# Naval Postgraduate School, Monterey, Calif.
THE APPLICATION OF NONLINEAR PROGRAMMING METHODS TO THE SOLUTION OF CONSTRAINED SADDLE-POINT PROBLEMS
John Timothy Hood (M.S. Thesis) Oct. 1969 64 p refs
(AD-705489) Avail: CFSTI CSCL 12/2

Nonlinear programming methods are used to solve saddle-point problems subject to inequality constraints on the variables; in particular, the type of saddle-point problem arising in pursuit-evasion differential games is considered. The methods investigated fall into two groups: solution of the nonlinear simultaneous equations obtained from the Kuhn-Tucker conditions, and solution of a sequence of constrained optimization problems by the gradient projection algorithm. These methods are applicable to any real-valued function f(x,y) which is convex in x, concave in y, and has continuous and bounded second partial derivatives. Several examples are given which illustrate the characteristics of the numerical procedures. Author (TAB)

N70-34083# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.
ADAPTIVE BAYES FILTERING WITH UNKNOWN PRIOR STATISTICS
Gary W. Husa and Andrew P. Sage 16 Apr. 1969 81 p refs
(Contract F44620-68-C-0023)
(AD-705247; AFOSR-70-0608TR) Avail: CFSTI CSCL 12/1

Two problems which occur when methods of optimal estimation are applied to an actual problem are the choice of prior statistics and the choice of a mathematical system model. This research discusses various existing methods for adaptively estimating system parameters and prior statistics and then presents the development of optimal and suboptimal Bayes estimation algorithms for filtering with unknown prior statistics. Author (TAB)

N70-34096# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
APPROXIMATE SOLUTIONS OF A NON-LINEAR DIFFERENTIAL EQUATION USING LAPLACE-TRANSFORM

AND REVERSION-OF-SERIES TECHNIQUES
Walter Tarnopilsky (M.S. Thesis) Dec. 1969 58 p refs
(AD-705490) Avail: CFSTI CSCL 12/1

The reversion-of-series method is extended to the s - domain by using non-linear Laplace transforms. The reversion of series in the s - domain is applied to a non-linear differential equation and approximate solutions are obtained. The approximate solution is modified for the case where the steady state is a constant value by calculating the exact steady-state value and applying it to the reversion approximation. The non-linear differential equation considered is Duffings equation with a damping term and sinusoidal and constant forcing functions. The theoretical solutions are compared to machine solutions. Author (TAB)

N70-34197# California Univ., Berkeley. Dept. of Electrical Engineering.
A NOTE ON THE ANALYTICAL ABSOLUTE STABILITY TEST Interim Report
E. I. Jury Feb. 1970 8 p refs
(Grant AF-AFOSR-1463-68)
(AD-701786; AFOSR-70-0516TR) Avail: CFSTI CSCL 12/1

A simplified version of the necessary and sufficient condition on the analytical absolute stability test is introduced. The absolute stability test requires that the following polynomial Pi (omega) = Summation from k=0 to k=n of ((a sub 2k)(omega to the 2k). a sub 0 > 0 has no positive real zeros. TAB

N70-34210# Center for Naval Analyses, Arlington, Va.
AN APPROACH TO SEMI-MARKOV PROCESSES
Stephen Saperstone 23 Mar. 1970 43 p refs *Its* Professional Paper no. 25
(AD-703537) Avail: CFSTI CSCL 12/1

The paper reports on some of the mathematical results that the author obtained while seeking to refine Markov chain models. In an effort to take into account the waiting time in each state prior to transition, a non-Markov process was postulated. Subsequent investigation showed the process to be a reformulation of a semi-Markov process. In the present case, the equations for the flow resemble a multi-dimensional renewal process. The behavior of the system is described by a probability density which characterizes the process at any time t > 0, given that the states of the process were defined at time t = 0. It is shown in the special steady state case that the probability distribution yields results which are equivalent to those previously given. Author (TAB)

N70-34233*# Georgia Univ., Athens. Dept. of Statistics.
TABLES OF MAXIMUM LIKELIHOOD ESTIMATING FUNCTIONS FOR SINGLY TRUNCATED AND SINGLY CENSORED SAMPLES FROM THE NORMAL DISTRIBUTION
Carolyn Gaines Cooley and A. Clifford Cohen Apr. 1970 100 p refs
(Contract NAS8-11175)
(NASA-CR-61330; TR-54) Avail: CFSTI CSCL 12A

Tables of auxiliary functions necessary for the practical application of estimators are greatly expanded over tables previously available both with respect to number of decimals in each entry and with respect to intervals of the arguments. Entries in tables of the estimating functions are given to nine decimals. The argument, gamma, ranges over 0.0260 (0.0001) 0.9159 for truncated samples and over 0 (0.001) 1.000 for censored samples. For censored samples, the proportion of censored observations, h, ranges over 0.01 (0.01) 0.20 (0.05) 0.90. Entries for h = 0 are omitted since in these cases the estimating function assumes the value zero. Author

N70-34243*# Case Western Reserve Univ., Cleveland, Ohio.
MAPPINGS AND GRAMMARS ON TREES
William C. Rounds [1969] 67 p refs
(Grant NGR-36-027-00)
(NASA-CR-109933) Avail: CFSTI CSCL 12A

Studied are certain sets, functions, and relations on trees using natural generalizations of ordinary automata theory in order to enlarge the domain of automata theory. Algebraic formulations to give descriptions of linguistic constructions are used to investigate decision problems and closure properties. Considered are finite, labeled, ordered, rooted trees such that no label occurs on two nodes which have different numbers of branches. A model for dendrogrammar is formulated and used to create infinite dendrolanguages from a finite input set. G.G.

N70-34250# California Inst. of Tech., Pasadena.
A GENERALIZATION OF THE MATRIX EQUATION A SQUARED = J
H. J. Ryser 1970 14 p refs
(Contract N000014-67-A-0094-0010; Grant DA-ARO / D /-31-124-G1138)
(AD-701787) Avail: CFSTI CSCL 12/1

A denotes a (0,1)-matrix of order n. I denotes the identity matrix of order n and J the matrix of order n with every entry equal to 1. A line of a matrix designates either a row or a column of the matrix. Extensive research in the general area of the matrix equation has been carried out. The results are of interest in the study of universal algebras and directed graphs. A solution of the matrix equation as the incidence matrix of a directed graph with exactly one path of length two between every pair of points is given. Author (TAB)

N70-34251# Denver Research Inst., Colo. Div. of Mathematical Sciences.
COERCIVENESS INEQUALITIES FOR NONELLIPTIC SYSTEMS OF PARTIAL DIFFERENTIAL EQUATIONS
John R. Schulenberger and Calvin H. Wilcox Mar. 1970 132 p refs
(Contract N00014-67-A-0394)
(AD-705075; MS-R-7011; TSR-4) Avail: CFSTI CSCL 12/1

The paper deals with first-order matrix partial differential operators of the form L = (-i) Summation, j = 1 to j = n, of ((L sub j)(x)(D sub j)) + L sub 0 (x) where x = (x sub 1, ..., x sub n)epsilon(R superscript n), D sub j = the partial dreivative with respect to j, and the L sub j (x), j = 0, 1, 2,..., n, are m x m matrix-valued functions of x. TAB

N70-34264# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF MEAN ABSOLUTE DEVIATION VARIABILITY
Ozden Ornek (M.S. Thesis) Oct. 1969 52 p refs
(AD-701679) Avail: CFSTI CSCL 12/1

Prediction of demand and setting reorder levels by exponential smoothing and mean absolute deviation is studied for an inventory system. The relation between the standard deviation and mean absolute deviation of demand distribution is discussed. Asymptotic first and second moments of the exponentially-smoothed forecast errors (MAD) are derived. Results obtained from simulation of several normal systems indicated that the smoothing technique is inferior to the classical maximum likelihood estimation method. Author (TAB)

N70-34286# Illinois Univ., Urbana. Coordinated Science Lab.
THE SENSITIVITY AND CONTROL OF DISTRIBUTED PARAMETER SYSTEMS
James Mumane Davis Apr. 1970 120 p refs
(Contract DAAB 07-67-C-0199; Grant AF-AFOSR-1579-68)
(AD-705434; R-464; UILU-eng-70-209) Avail: CFSTI CSCL 12/1

Three areas of investigation are considered. The first area is the sensitivity problem for distributed parameter systems. A

review of the sensitivity problem is given and a new result is presented in the form of sufficient conditions to insure that the comparison sensitivity criterion is satisfied. This result allows the solution of a whole new class of previously unsolvable problems. Specifically, this class consists of those distributed parameter systems described by linear constant coefficient non-separable partial differential equations. The second problem involves the investigation of distributed parameter systems with separable controllers. This class of distributed parameter system has time-dependent control action which is constrained to known functions of the systems independent spatial variables. A study is presented in Chapter 4 of the error incurred through the application of ordinary differential equation optimization algorithms to the set of ordinary differential equations obtained by applying finite difference techniques to the partial differential equations describing the distributed parameter system. TAB

N70-34293# Naval Postgraduate School, Monterey, Calif.
BOUNDARY VALUE APPLICATION OF A ONE DIMENSIONAL MAXIMUM PRINCIPLE
James Dale Jones (M.S. Thesis) Jun. 1969 67 p refs
(AD-701676) Avail: CFSTI CSCL 12/1

The problem considered is the application of a one-dimensional maximum principle to second order, linear differential equations of the form u + g(x)u + h(x)u = f(x) for a < x < b with associated general boundary conditions to obtain functions z1(x) and z2(x) such that z2(x) = or < u(x) = or < z1(x) on the closed interval (a,b). The functions f, g, and h are assumed to be bounded. We wish to determine the behavior of the solution u(x) on the closed interval (a,b) and also to obtain reliable numerical estimates of u. Author (TAB)

N70-34336# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
A BIFURCATION PROBLEM FOR A FUNCTIONAL DIFFERENTIAL EQUATION OF FINITELY RETARDED TYPE
Nathaniel Chafee Apr. 1970 66 p refs
(Grant AF-AFOSR-693-67)
(AD-705210; AFOSR-70-1050TR) Avail: CFSTI CSCL 12/1

The qualitative behavior of solutions near an equilibrium point of an autonomous functional differential equation of finitely retarded type is examined. In particular, under certain appropriate hypotheses, it is shown that, as a certain parameter varies in a prescribed way, a family of one or more periodic orbits of the given equation bifurcates from the given equilibrium point. Suitable stability properties of these closed orbits are determined. TAB

N70-34339# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.
A FIXED CONFIGURATION APPROACH TO STOCHASTIC CONTROL Interim Scientific Report
Craig S. Sims and James L. Melsa 5 Jan. 1970 106 p refs
(Contract F44620-68-C-0023)
(AD-705609; AFOSR-70-0607TR) Avail: CFSTI CSCL 12/1

A general two-point boundary-value problem (TPBVP) formulation is developed for a large class of stochastic optimization problems under a variety of control structure specifications. The application of the fixed-configuration technique to the stochastic linear regulator problem, and a class of stochastic nonlinear regulator problems is investigated. In the nonlinear case, analysis is not exact, and evaluation of the use of the method is with respect to the particular problem considered. The results obtained by investigating application of the fixed-configuration method to the stochastic linear regulator problem are of a more general nature. Some useful aspects of the approach are: (1) Alternate derivations of familiar optimal results are obtained. (2) It is shown that the optimal controller is not unique. (3) Simplified lower control structures are shown to be feasible. On the particular example investigated, near optimal results are obtained when a lower order control structure is used. Author (TAB)

N70-34376# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.
HOMOMORPHIC FILTERS FOR CONVOLVED FUNCTIONS Interim Scientific Report
Jagdish C. Prabhakar and Someshwar C. Gupta 5 Dec. 1969 69 p refs
(Contract F44620-68-C-0023)
(AD-705608; AFOSR-70-0606TR) Avail: CFSTI CSCL 9/4

The capabilities of a limited class of non-linear systems have been demonstrated. The convolution in its continuous structure is an integral equation involving two or more time functions. Given the value of this integral, it is usually difficult to evaluate the constituent parts. The homomorphic filters discussed in this work accomplish the filtering process through the principle of generalized superposition. This principle enlarges the applicability of principles of superposition and homogeneity (applicable to the well understood linear systems) by associating a vector space with the inputs to non-linear systems. It is then possible to define a linear transformation which maps an input space to another vector space. However, the number of useful relationships which correspond to the vector addition for the vector space is limited. The linear transformations have been worked out for multiplication and convolution of input elements, besides the familiar case of algebraic addition which does not require this abstract treatment. This dissertation demonstrates the application of the principle of generalized superposition by separating the probability density functions. The functions considered as those that arise in the F.M. detection process and result from the addition of two independent random variables. Author (TAB)

N70-34442# Denver Research Inst., Colo. Div. of Mathematical Sciences.
COMPLETENESS OF THE WAVE OPERATORS FOR PERTURBATIONS OF UNIFORMLY PROPAGATIVE SYSTEMS
John R. Schulenberger and Calvin H. Wilcox Feb. 1970 47 p refs
(Contract N00014-67-A-0394)
(AD-705076; MS-R-7010; TSR-5) Avail: CFSTI CSCL 12/1

The paper deals with perturbations of uniformly propagative systems of the form E(x)(D sub t)(u) + Summation j = 1 to n of (A sub j)(D sub j)(u) = 0 where the matrices A sub 1, ..., A sub n are constant and E(x) is uniformaly bounded and positive definite in R superscript n. TAB

N70-34515*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TESTING FOR NORMALITY WITH THE KOLMOGOROV-SMIRNOV TEST
A. H. Feiveson 3 Sep. 1968 15 p refs
(NASA-TM-X-64331; MSC-ED-IN-68-75) Avail: CFSTI CSCL 12A

A guide for using the Komogorov-Smirnov goodness of fit test is provided when testing for normality, especially in cases where the mean and variance must be estimated from the sample. Author

N70-34614# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
ON THE FOUNDATIONS OF COMBINATORIAL THEORY. 4: FINITE VECTOR SPACES AND EULERIAN GENERATING FUNCTIONS
Jay Goldman and Gian-Carlo Rota (MIT) 17 Apr. 1970 54 p refs
(Contract N00014-67-A-0298-0017)
(AD-705612; TR-31) Avail: CFSTI CSCL 12/1

The paper studies combinatorial aspects of the lattice of subspaces of a vector space over a finite field and its use in deriving classical and new q-identities. Set theoretic interpretations of these identities are given in terms of the enumeration of vector spaces and linear transformations. The incidence algebra of a partially ordered set is shown to be a true generalization of the notion of a generating function and Eulerian generating functions are applied to count a variety of vector space objects. Combinatorial interpretations are provided for general q-difference equations.
Author (TAB)

N70-34626*# Techtran Corp., Glen Burnie, Md.
ENGINEERING FORMULAS FOR SOLVING BOUNDARY VALUE PROBLEMS FOR THE HELMHOLTZ AND POISSON EQUATIONS BY THE METHOD OF SUMMARY REPRESENTATIONS [O RASCHENYKH FORMULAKH RESHENIYA KRAYEVYKH ZADACH DLYA URAVENIY GEL'MGOL'TSA PUASSONA METODOM SUMMARNYKH PREDSTAVLENKY]
P. I. Chalenko et al Washington NASA Aug. 1970 22 p refs Transl. into ENGLISH from Vychisl. i Prikl. Mat., no. 8, 1969 p 22–39
(Contract NASw-2037)
(NASA-TT-F-13059) Avail: CFSTI CSCL 12A

Derivation of summary representation formulas for solving boundary value problems for the Helmholtz equation in a rectangle. These formulas are obtained for any combinations of the boundary conditions of the Dirichlet and Neumann problems at the horizontal and vertical sides of the rectangle. Similar formulas are obtained for the solution of boundary value problems for the Poisson equation in a rectangle and an annular sector. Author

N70-34734# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.
ANOMALY IN THE USE OF THE SECOND-ORDER FORM OF THE DISCONTINUOUS VARIATIONAL METHOD
Martin Becker 30 Apr. 1970 5 p refs
(Contract AT(30-1)-328)
(RPI-328-188) Avail: CFSTI

It is shown that, for a general class of reactor physics problem, the use of the second order form of the discontinuous variational method does not yield a nontrivial solution. Use of the second order form on the functional for a Sturm – Liouville equation is observed to not provide a useful algorithm for generating approximate solutions. NSA

N70-34795# Harvard Univ., Cambridge, Mass. Lab. for Computer Graphics and Spatial Analysis.
HOMOLOGICAL TRANSFORMATIONS IN FOUR-DIMENSIONAL SPACE Interim Report
C. Ernesto S. Lindgren 25 Nov. 1969 22 p *Its* Paper 35
(Contract N00014-67-A-0298)
(AD-704806; ONR-TR-35) Avail: CFSTI CSCL 12/1

The development of geometrical methods applicable to problems in geography and regional planning requires the detailed study of the theoretical foundation upon which those methods are based. This is the obvious requirement for any scientific investigation where theory, research (development of the methodology), and application are discussed in that order. The paper deals with one of such methods, namely, the study of the homological transformations in a plane in four-dimensional space. The theoretical foundation is the four-dimensional descriptive geometry. A brief discussion is made introducing three of the most important methods of representation. Complementing the study, three problems of practical value are presented, pointing out that their solutions depend on the use of the methodology introduced in the paper.
Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-33402# Israel Program for Scientific Translations, Ltd., Jerusalem.
VOEIKOV MAIN GEOPHYSICAL OBSERVATORY, 1917–1967
M. I. Budyko, ed. 1970 367 p refs Transl. into ENGLISH of the book "Glavnaya Geofizicheskaya Observatoriya Imeni A. I. Voeikova. Za 50 Let Sovetskoi Vlasti" Leningrad, Gidrometeorologicheskoe Izd., 1967 Prepared for ESSA and NSF
(TT-68-50493) Copyright: Avail: CFSTI

A collection of papers concerning weather forecasting, statistical structure of meteorological fields, climatological research and climate mapping, development of meteorological instruments, chemical composition of atmospheric precipitation, and an investigation of the meteorological regime of the Arctic and Antarctica is presented. J.M.C.

N70-33490# Bureau of Meteorology, Melbourne (Australia).
AUSTRALIAN CLIMATOLOGICAL SUMMARY: UPPER AIR DATA, NOVEMBER 1969
Nov. 1969 17 p
Avail: CFSTI

Meteorological statistics are presented for daily observations of upper atmosphere wind, temperature, and humidity in the Australian region. The data also include geopotential, monthly mean values for temperature, monthly median mixing ratio values for humidity, and monthly vector mean wind values. R.B.

N70-33497# Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 95, NO. 4: DAILY AND MONTHLY NORTHERN HEMISPHERE 30-MILLIBAR-SYNOPTIC WEATHER MAPS OF THE YEAR 1968. PART 4: OCTOBER–DECEMBER Final Technical Status Report
Dietrich Just, Barbara Kriester, Karin Labitzke, Renate Lenschow, Karen Petzoldt et al 1969 115 p
(Contract DAJA37-68-C-1104)
(AD-705643) Avail: CFSTI CSCL 4/2

These reports are published quarterly and present 30 mb maps, day by day, throughout October - December 1968. Height and temperature data are plotted on each chart and appropriate contours are drawn. A discussion of the stratospheric circulation for this quarter is included. Each volume also contains mean monthly maps and charts of changes in the means from month to month, for the appropriate months. Tables of mean gridpoint data, plotting models and the distribution of rocket stations are included.
Author (TAB)

N70-33503# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, no. 229 26 May 1970 p 7–20 refs (See N70-33501 18-34)
Avail: CFSTI

Abstracts and summaries are reported on research in aerosols for cloud modification, the launching of a Meteor satellite, experimental radar tracking of clouds over Tien Shan mountains, the use of radar in shower and thunderstorm forecasts, mesojets over Moscow, Soviet work in nuclear meteorology, the Spring restructuring of circulation in the Southern Hemisphere, spectral studies of the twilight aureole in the earth's atmosphere, study of the field of terrestrial radiothermal radiation, fronts and convergence zones on radiation temperature maps, radiation fluxes and heat

influx to the atmosphere, spatial and temporal variability of cloud cover, statistical methods in analyzing and predicting meteorological fields, the development of the cloud vortex of a cyclone from satellite data, formation of strong squalls from satellite and radar data, evaluation of clear air turbulence parameters, fluctuations in intensity of laser beam in a turbulent atmosphere, changes in radiation temperature during evolution of fronts, a method for reducing the blind zone of weather radar, and parameters of spherical waves propagating in a turbulent atmosphere. R.B.

N70-33538# Bureau of Meteorology, Melbourne (Australia). Australian National Antarctic Research Expeditions.
METEOROLOGY: MACQUARIE ISLAND, MAWSON AND WILKES, 1967
Dept. of Supply 1970 460 p *Its* ANARE Data Rept. Ser. D (20) Meteorol.
(Publ-113) Avail: CFSTI

Meteorological observations made at Macquarie Island, Mawson, and Wilkes during 1967 are tabulated. Surface, radiosonde, and upper wind data are presented as listings and also in the form of cumulated frequency analyses. Author

N70-33558# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 227 30 Apr. 1970 p 9-27 (See N70-33556 18-34)
Avail: CFSTI

News releases of meteorological activities, and summaries of published articles in the U.S.S.R. are reported. Topics include jet streams, atmospheric circulation, and frontal fog forecasting. F.O.S.

N70-33574# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 226 14 Apr. 1970 p 14-31 (See N70-33572 18-34)
Avail: CFSTI

Book reviews are presented concerning atmospheric radiation characteristics, mesometeorological processes, and solar tropospheric relationships. The frontal process theory in synoptic and dynamic meteorology is discussed, including cyclonic and frontal cloud evolution, precipitation, and hail prediction. A method for computing the velocity of vertical air currents is assessed using aircraft acceleration simulation. The apparatus on a Meteor satellite launched March 17, 1970 is briefly reviewed. Abstracts are also noted on meteorological literature.

N70-33730# Environmental Science Service Administration, Boulder, Colo. Research Labs.
PROGRESS IN HAILSTORM RESEARCH
Helmut K. Weickmann May 1969 24 p refs
(ESSA-ERL-129-APCL-7) Avail: SOD $0.35

One of the most difficult problems that confront scientists in advancing research on hail suppression is the lack of knowledge of the mesometeorological life history of hailstorms. Hailfall at the surface cannot be related to the active hail-producing cell in the hailstorm aloft. Three aircraft were equipped to be an independent mesometeorological observation and analysis system, to probe air motions, divergence, and vorticity around the storm and to record the three-dimensional radar structure. Hailfalls are being closely observed from the air by means of infrared techniques; cloud dimensions and development are being studied by stereophotogrammetric techniques. Results of a few case studies are presented. Author

N70-33744# Institute for Telecommunication Sciences, Boulder, Colo. Research Labs.
MEASUREMENT OF DIVERGENCE IN MESOMETEOROLOGICAL SYSTEMS
Heinz H. Grote Jan. 1970 33 p ref
(ESSA-TR-ERL-149-APCL-13) Avail: SOD $0.40

A computer simulation of a circular flight loop with Gaussian distributed input errors provides the output error in the computation of divergence, vorticity, actual and average wind, coordinates, and area. The output error is presented as a function of two levels in input errors. Author

N70-33766# Utah Univ., Salt Lake City. Dept. of Electrical Engineering.
A DATA REDUCTION COMPUTER PROGRAM FOR THE AFCRL TRIAXIAL ACCELEROMETER INFLATED FALLING SPHERE ATMOSPHERIC DENSITY MEASURING SYSTEM Final Report, 1 Dec. 1968 - 31 Aug. 1969
Forrest L. Staffanson and Ray G. Phibbs Oct. 1969 234 p refs
(Contract F19628-69-C-0124)
(AD-705566; UTEC-MR-69-140; AFCRL-69-0446) Avail: CFSTI CSCL 4/2

A digital program is presented for the automatic processing of flight data from the triaxial accelerometer inflated falling sphere system developed by Air Force Cambridge Research Laboratories for the measurement of upper atmospheric air density. The program also computes the uncertainty of each final data point according to input estimates of component uncertainties and computed varying measures of data quality. Results using flight data from three recent launchings of the experiment are presented (16 and 23 May 1968 at Kauai, Hawaii and 31 January 1969 at Wallops Island, Virginia). Author (TAB)

N70-33802# Environmental Science Services Administration, Boulder, Colo. Research Labs.
PLOTTER SUBROUTINE (COMBI) FOR METEOROLOGICAL FLIGHT PATH AND FOUR PARAMETERS
Heinz H. Grote Apr. 1970 55 p refs
(ESSA-TR-ERL-155-APCL-14) Avail: SOD $0.60

A computer subroutine COMBI is described that provides, together with the subroutine CRTPLT, a plot of a meteorological flight path with wind vectors and time notations surrounded by a graphical presentation of four meteorological parameters measured along the flight path. Author

N70-33804# Weather Wing (1st), San Francisco, Calif.
FORECASTING SNOWSHOWERS AT MISAWA AIR BASE, JAPAN
George Taniguchi Feb. 1970 34 p refs *Its* Tech. Study 20
(AD-705567) Avail: CFSTI CSCL 4/2

The study describes various snowshower forecast methods that have been attempted at Misawa AB, Japan. A brief summary of each method is presented. Conclusion, at the present state of the art only favorable conditions for snowshowers can be predicted. Author (TAB)

N70-33805# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
OPERATIONAL EVALUATION OF A CEILING AND VISIBILITY PREDICTION TECHNIQUE Final Report
Roger A. Allen Dec. 1969 23 p refs
(Contract FA-65-WAI-90)
(W421; FAA-RD-70-17) Avail: CFSTI

Statistical forecasts of ceiling and visibility were computed in real time for eight major terminals and transmitted for the information of the forecasters preparing the official forecasts. Verification of subjective forecasts made before and after examination of the statistical forecasts provided an estimate (in terms of an

arbitrary score) of the usefulness of the statistical forecasts as guidance. The experiment demonstrated the feasibility of distributing such forecasts from a central computer, and provided information on the stability of statistical forecast equations when derived from a large data sample and applied to a much later period. The equations were strongest in forecasting visibility seven hours in advance. Their greatest weakness was in the prediction of short period changes in low ceilings and low visibilities. Author

N70-33810# Weather Bureau, Silver Springs, Md.
DEVELOPMENT OF BASE TECHNIQUES FOR CEILING AND VISIBILITY PREDICTION. Interim Report, Jan. 1967 - Dec. 1969
John Keaty and Roger A. Allen Feb. 1970 24 p refs
(Contract FA-67-WAI-131)
(W421; FAA-RD-70-22) Avail: CFSTI

Base equations were developed for 12 terminals representing nearly all sections of the conterminous United States for predicting ceiling and visibility 2, 3, 5, 8, and 12 hours in advance. The equations are based upon simple predictor variables as observed at a network of stations surrounding and including the predictand station. Forecasts made by these equations are in terms of the probability of occurrence of each of 5 categories of ceiling and 5 of visibility. The equations were tested on independent data and the verification scores were adjusted to take partial account of differences in the climatic frequency distribution of the predictands. It was found that a considerable degree of predictability is provided by these equations, particularly for projections of only a few hours. The equations are very stable because they are based on large data samples, although some degradation of scores occurred when applying the equations to independent data. Author

N70-33870# Environmental Science Services Administration, Boulder, Colo. Research Labs.
PLOTTER SUBROUTINE FOR METEOROLOGICAL FLIGHT PATH (PATH)
Heinz H. Grote Dec. 1969 22 p refs
(ESSA-TR-ERL-139-APCL-9) Avail: SOD $0.30

A subroutine - PATH - that works in connection with the plotter subroutine CRTPLT to provide a two dimensional plot of a meteorological flight path with wind vectors, time notations, and a legend is described. Author

N70-33872# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
ON THE DYNAMIC STABILITY OF CONVECTIVE ATMOSPHERIC VORTICES
Kenneth Harris Bergman (Ph.D. Thesis) Feb. 1970 170 p refs
(Contract DA-AMC-28-043-68-G6)
(AD-705667; ECOM-68G6-1) Avail: CFSTI CSCL 4/2

Some characteristics of convective atmospheric vortices, with special reference to dust devils, are first discussed, and the presence of certain phenomena indicating dynamic instability is indicated. Theoretical models of steady vortex flow are then reviewed, and observational evidence for a two-cell structure with reversed axial flow in convective atmospheric vortices is presented. A vortex model of this kind suitable for atmospheric application is chosen to describe the undisturbed flow state of a convective atmospheric vortex within the layer where ambient thermal instability prevails. The linearized equations for periodic disturbances of vortex flow are then developed and known stability criteria obtainable from them are reviewed. The equations are then applied to the chosen vortex model. Solutions, obtained by numerical methods, of the dynamic stability problem thus formulated are presented and discussed. The theoretical results are compared with available visual observations of dust devils, and a discussion of possible implications of dynamic instability for dust devil formation and dissipation is given. TAB

N70-33905# Weather Wing (1st), San Francisco, Calif.
THE AUGUST 1969 ATMOSPHERIC SINGULARITY: SOUTHEAST ASIA
Lynn L. LeBlanc Apr. 1970 56 p ref *Its* Tech. Study 21
(AD-705568) Avail: CFSTI CSCL 4/2

The study describes the progression of the tropical buffer ridge as it moves north through Southeast Asia producing clear weather. This same synoptic situation had previously been identified with July. Author (TAB)

N70-33921# Chicago Univ., Ill. Lab. for Atmospheric Probing.
WAVES, TURBULENCE, AND INSECTS AS SEEN BY ULTRA HIGH RESOLUTION RADAR
David Atlas, Juergen H. Richter, and Earl E. Gossard Oct. 1969 49 p refs
(Contract N00014-67-A-0285-0007)
(AD-705622; TR-13) Avail: CFSTI CSCL 4/2

A unique frequency-modulated continuous wave (FM-CW) radar has been developed at the Naval Electronics Laboratory Center, San Diego, California which has a combination of great sensitivity and ultra-high resolution for the detection of atmospheric structures. In particular, it routinely detects and displays the fine scale features of many, if not most, inversions in the lower two kilometers of the clear atmosphere. The observations made to date are highly meaningful in a variety of meteorological contexts; for example, (1) in understanding the mechanisms of turbulence generation in hydrostatically stable layers in general, and more specifically, (2) in revealing the origins of clear air turbulence, (3) in detecting CAT, (4) in advancing our knowledge of convection and the boundary layer, (5) in studying the structure and metamorphosis of inversions, (6) in tropospheric radio scatter propagation and (7) in air pollution. The present report discusses the relevance of the new observations to most of these topics. In addition it deals with certain new aspects of dot angel echoes from insects. Author (TAB)

N70-33931# Joint Publications Research Service, Washington, D.C.
METEOROLOGY FROM SPACE ALTITUDES
K. Kondratyev 25 Jun. 1970 16 p Transl. into ENGLISH from Nauka Zhizn (USSR), no. 4, 1970 p 142 - 149
(JPRS-50814) Avail: CFSTI

Satellite observations and systems for obtaining meteorological information are discussed. Satellite instrumentation, infrared photography, cloud photointerpretation, and data transmission are described. The ground support systems, on land and sea and in the air, are covered, and the possible use of manned orbital space laboratories is mentioned. Emphasis is on cloud pattern interpretation from satellite photographs. N.E.N.

N70-33989*# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
DETERMINATION OF MASS OUTFLOW FROM A THUNDERSTORM COMPLEX USING ATS 3 PICTURES
T. T. Fujita and D. L. Bradbury Apr. 1969 16 p refs *Its* SMRP Res. Paper No. 79
(Grants NGR-14-001-008; ESSA-E-22-45-68-(G); ESSA-E-198-68-(G))
(NASA-CR-109796) Avail: CFSTI CSCL 04B

Presented in this paper are some preliminary results of the tornado watch experiment, 1968. Two excellent cases of tornado outbreaks over the Midwest were photographed at 14-min intervals by ATS III. One of the cases occurred on April 19 and was studied together with aerological and surface data, radar pictures, and cloud displacement computation from ATS pictures. It was found that there was little evidence of mesoscale divergence of high-cloud velocities prior to the storm foundation. As the storm

grew rapidly, a significant divergence at the anvil level modified the field of jetstream-cloud velocities. This preliminary study resulted in a number of new questions to be answered in the future. Author

N70-34029 National Lending Library for Science and Technology, Boston Spa (England).
THE INFLUENCE OF OROGRAPHY ON THE GENERAL CIRCULATION OF THE ATMOSPHERE
M. A. Petrosjanc 8 Apr. 1970 27 p refs Transl. into ENGLISH from Mezd. Geofiz. Kom. (USSR), no. 16, 1968 p 210-238 (NLL-M-9056-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

The mechanical and thermodynamic effects of mountain ranges on weather front movements are summarized, emphasizing the Andes, the Central Asian Massif, and the Rocky Mountains. Changes in seasonal climate, depressions, anticyclones, geopotential, and wind velocity caused by mountains are included. J.A.M.

N70-34035# National Air Pollution Control Administration, Raleigh, N.C.
THE CLIMATE OF CITIES: A SURVEY OF RECENT LITERATURE
James T. Peterson Oct. 1969 53 p refs
(PB-190260; NAPCA-Pub-AP-59) Avail: SOD $0.55 CSCL 04B

The climate of a city differs from that of the rural areas surrounding it and an increasing amount of scientific research is devoted to comparative studies of urban and rural climates. A survey of the literature on city climatology is given. Those meteorological aspects of urban climate that have been most frequently investigated are discussed, including temperature, humidity, visibility, radiation, wind, and precipitation. Author (USGRDR)

N70-34040 National Lending Library for Science and Technology, Boston Spa (England).
ALLOWANCE FOR CLIMATIC FACTORS IN THE EXPLOITATION OF POLYMER MATERIALS IN THE OPEN AIR
V. P. Hodakova 8 Apr. 1970 9 p refs Transl. into ENGLISH from Tr. Glav. Geof. Obs. (USSR), no. 247, 1969 p 115-121 (NLL-M-9117-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The variation of temperature and humidity parameters were studied in their interrelation with the physico-chemical properties (impact strength and static bending) of polymers in the open air. It is concluded that it is possible for physico-mechanical properties to return to earlier observed values in the process of aging, and no conclusion can be drawn about thermal stress in a climatic regime. F.O.S.

N70-34080# Air Force Cambridge Research Labs., Bedford, Mass.
VERTICAL SHEAR MODES IN INERTIAL WAVES ON A ROTATING EARTH
Harry E. Moses Mar. 1970 21 p refs
(AD-705184; AFCRL-70-0159; AFCRL-PSRP-413) Avail: CFSTI CSCL 4/1

Knowledge and understanding of upper atmospheric winds (air motions) are important elements in the design and operation of vehicles traversing this regime. This report describes mathematically some of these air motions and relates them to observations made using chemical trails. Author (TAB)

N70-34099*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
DYNAMICAL ANALYSIS OF OUTFLOW FROM TORNADO-PRODUCING THUNDERSTORMS AS REVEALED BY ATS 3 PICTURES
K. Ninomiya Dec. 1969 45 p refs
(Grants Ngr-14-001-008; ESSA-E22-41-69(G); ESSA-E-198-68(G))
(NASA-CR-109790; SMRP-81) Avail: CFSTI CSCL 04B

Detailed synoptic and dynamic analyses of outflow from tornado-producing thunderstorms of April 23, 1968 were made by using conventional rawinsonde data combined with ATS III pictures. It was found that the pre-existing flow at the cirrus level over storm areas changed dramatically into outflow as the storms developed. When the storms reached their mature stage, the horizontal dimensions of the outflow increased to about 500 km. Detailed analyses of rawinsonde data inside the outflow area revealed the existence of a mid-tropospheric warm core accompanied by a significant field of convergence below the 700-mb surface. Quantitative analysis of the thermodynamical and dynamical aspects of the outflow field showed that the outflow was induced and maintained by convective warming. Author

N70-34106# Air Force Cambridge Research Labs., Bedford, Mass.
PROCEEDINGS OF THE WORKSHOP ON METHODS OF OBTAINING WINDS AND DENSITIES FROM RADAR METEOR TRAIL RETURNS
Arnold A. Barnes, Jr. and Joseph J. Pazniokas, eds. Apr. 1968 350 p refs Conf. held at Waltham, Mass., 16-19 Apr. 1968; sponsored by AFCRL *Its* Spec. Rept. No. 75
(AD-675148; AFCRL-68-0228) Avail: CFSTI

Methods for deriving wind, height, and atmospheric density data from radar meteor trail returns are described. Height resolution and data rates needed for climatological, tidal, and turbulence studies are delineated. For individual titles, see N70-34107 through N70-34132.

N70-34114# Air Force Cambridge Research Labs., Bedford, Mass.
CHAIRMAN'S REMARKS
Arnold A. Barnes, Jr. *In its* Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 103-106 (See N70-34106 18-20)
Avail: CFSTI

The use of radar meteor trail winds and densities for determining the general circulation of the mesophere is described and international cooperation of the various worldwide meteorological radar stations is advanced. Available information on noctilucent cloud winds, rocket measurements, visual meteor trails, and radio meteor trail measurements can provide a sufficient quantity of data to compute momentum transport. G.G.

N70-34115# Georgia Inst. of Tech., Atlanta.
HEIGHT AND WIND ACCURACY, UNIVERSITY OF ADELAIDE SYSTEM
Robert G. Roper *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 107-129 (See N70-34106 18-20)
Avail: CFSTI

The University of Adelaide Meteor Wind System combines both cw and pulse techniques and an "all sky" antenna system to determine winds in the meteor region. The pulse radar is used only to determine the range of the meteor trail reflection point from the TR system. The accuracy of range determination is better than + or − 2 km. The direction of arrival of the echo is determined by a comparison of the cw signals as received by an array of five suitably spaced antennas. Error in the determination of angle of arrival is less than 1 deg. The error in the height calculated from the echo range and zenith angle is thus of order + or − km. Height differentials as measured on a single trail by the spaced receiving station technique are considerably more accurate than the differences in echo height determined by comparing the absolute heights of more than one trail. Height differences on an individual trail can be determined to an accuracy of better than 30 meters per kilometer. Author

N70-34117# Air Force Cambridge Research Labs., Bedford, Mass.
THE AFCRL SYSTEM, 1
Joseph J. Pazniokas *In its* Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 139–146 (See N70-34106 18-20)
Avail: CFSTI

An analysis is made of range, height, and elevation angle errors before computing wind velocity. The method of computing the wind velocity is described with emphasis on the Doppler equations of physics. Two equations are given assuming that the transmitter is a stationary source, and the meteor trail is a moving observer, so that a positive sign means the meteor trail is approaching the source. J.M.C.

N70-34119# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE HAVANA SYSTEM
Richard B. Southworth *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 161–169 (See N70-34106 18-20)
Avail: CFSTI

A description of the six stations set up for the radar observation of the meteors is given. Phase coherence was added to the system for measuring winds and to measure the return phase as well as the return amplitude. The six stations described have Yagi antennas. Emphasis is placed on establishing coordinates for wind measurement. J.M.C.

N70-34120# Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
THE FRENCH SYSTEM
Isaac Revah *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 171–175 (See N70-34106 18-20)
Avail: CFSTI

Elevation, azimuth, distance, and the phase of the reflected wave as a function of time parameters were used to compute the height of the point of reflection of the trail, the horizontal coordinates of this point of the reflection of the trail, and the wind velocity of this same period. Theoretically a localization of the order 500 meters was obtained. Measurements obtained had an accuracy which was near plus or minus one kilometer on the phase measurement and on the horizontal coordinate. J.M.C.

N70-34121# Sheffield Univ. (England).
UPPER ATMOSPHERIC WIND PARAMETERS FROM RADIO METEORS
T. R. Kaiser *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 177–193 refs (See N70-34106 18-20)
Avail: CFSTI

Information concerning the wind structure in the meteor region can be obtained from measurements of the Doppler shift in radio waves reflected from meteor trains and from the fading of enduring meteor echoes due to train distortion. It is shown that the wind shear can be deduced from the time variation in the Doppler shift. Particular attention is given to fading observations since they are much simpler to make than the Doppler measurements, requiring much less sophisticated apparatus. It is shown that measurements of the time delay, before the onset of fading and of the initial fading period, should yield useful information concerning the magnitude and vertical scale of the wind structure. Author

N70-34122# Adelaide Univ. (Australia).
UPPER ATMOSPHERIC WIND OBSERVATIONS AT ADELAIDE
W. Graham Elford *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 195–210 refs (See N70-34106 18-20)
Avail: CFSTI

The main features of upper atmospheric winds determined from radio observations of drifting meteor trails carried out at Adelaide are described. The seasonal behavior of the prevailing, and 24- and 12-hour periodic components over the height range 80 to 100 km was established. A weak but significant 8-hour periodic component was revealed by spectral analysis. Small scale turbulence was studied using several spaced stations; one notable result is the semi-annual variation in the rate of dissipation of turbulent energy. Author

N70-34131# Air Force Cambridge Research Labs., Bedford, Mass.
DISCUSSION OF DATA FORMAT AND REQUIRED RATES AND ACCURACIES FOR WIND STUDIES
In its Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 293–317 (See N70-34106 18-20)
Avail: CFSTI

A suggestion that a format on meteor trail data be submitted to the World Meteorological Organization is discussed. The type of information, the choice of raw or interpreted data, depth of detail, and related topics are covered. The recommended types of data are summarized. N.E.N.

N70-34132# Sheffield Univ. (England).
ATMOSPHERIC TIDES IN THE METEOR ZONES
Heinz G. Mueller *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 319–339 refs (See N70-34106 18-20)
Avail: CFSTI

The results of observations of upper atmospheric winds made during the IQSY by the radio meteor technique at Sheffield are described and discussed. Comparison is made with other data obtained in the Northern Hemisphere. Author

N70-34147 National Lending Library for Science and Technology, Boston Spa (England).
THE QUESTION OF THE RELATIONSHIP BETWEEN CLOUD PARAMETERS AND FORMULAE RELATING z AND I
I. V. Gryckiv et al 9 Apr. 1970 13 p refs Transl. into ENGLISH from Tr. Inst. Eksp. Met. (USSR), no. 6, 1969 p 110–130 (NLL-M-9096-(5828.4F) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The relation of precipitation intensity to radar reflectivity was studied by spectral measurements of raindrops made by filter paper, by synoptic and contour charts, and data from aircraft soundings. Results of the study are tabulated. It is concluded that the relationship depends in a complicated way on cloud parameters, but cannot be established with available data. F.O.S.

N70-34148 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF THE PHOTOSENSITIVITY OF SILVER IODIDE ON ITS CAPACITY FOR CRYSTALLIZING A SUPERCOOLED FOG
V. N. Balabanova 9 Apr. 1970 10 p refs Transl. into ENGLISH from Tr. Inst. Eksp. Met. (USSR), no. 6, 1969 p 131–136 (NLL-M-9097-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The photolytic dissociation of silver iodide exposed to solar radiation was studied to determine the effect on the crystallizing ability in supercooled fog. It is concluded that the action of radiant energy on silver iodide reduces the initial number of active crystallization nuclei; the deactivation of the nuclei is less when the humidity is increased to 100%, and repeated melting of water droplets frozen under the action of AgI deactivates the crystallization nuclei. F.O.S.

N70-34163 National Lending Library for Science and Technology, Boston Spa (England).
FREQUENCIES OF WIND-SPEEDS ACCOMPANYING ICING OF WIRES
C. A. Sver 24 Jun. 1970 11 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 246, 1969 p 114–121
(NLL-M-9226-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The frequency of wind speeds causing ice on transmission lines for different regions of the U.S.S.R. were studied for stations recording the phenomenon 20 or more times. Results of the data analysis are presented. It is concluded that in 90% of the cases icing is accompanied by winds of less than 6 m/sec while crystalline hoar frost is scarcely ever observed with winds of more than 4 m/sec. F.O.S.

N70-34229# Hawaii Univ., Honolulu.
ENERGY BUDGET RESEARCH IN HAWAII. PART 1: MICROCLIMATIC STUDIES
Prem C. Prasad [1970] 33 p refs
(Grant ESSA-E265-68(G))
(PB-190187) Avail: CFSTI CSCL 04B

Research interest in the measurement of incident radiation in Hawaii is demonstrated by a brief review of the instrumentation by Hawaiian Sugar Planters' Association for plantation use based on specific criteria. Selected aspects of research currently in progress dealing with the various components of the energy budget on micro scale are discussed. Preliminary results on the relationship between consumptive water use by sugar cane are presented. The utility of the USWB plan for irrigation control is confirmed. Recommendations for future energy budget studies on sugar cane in Hawaii are made. Author (USGRDR)

N70-34230# Hawaii Univ., Honolulu.
ENERGY BUDGET RESEARCH IN HAWAII. PART 2: THE DISTRIBUTION OF SURFACE COEFFICIENTS IN THE HAWAIIAN ISLANDS
J. O. Juvik [1970] 13 p refs
(Grant ESSA-E265-68(G))
(PB-190188) Avail: CFSTI CSCL 04B

Ongoing research concerns the horizontal integration of energy and mass budget parameters in the Hawaiian Islands. Work is in progress to describe the energy balance on a regional scale, with the prospect of answering such questions as: do the Hawaiian Islands serve as a heat source or sink. This paper treats only one aspect of the energy budget equation, the surface reflection coefficient. Measured and estimated values of surface reflection coefficient have been mapped, based on land-use, and an average coefficient derived for each Island. Author (USGRDR)

N70-34258# Texas A&M Univ., College Station. Water Resources Inst.
WATER TRANSFER FROM SOIL TO THE ATMOSPHERE AS RELATED TO CLIMATE AND SOIL PROPERTIES Technical Report, 1 Feb. 1966–30 Jun. 1969
Charles W. Wendt Feb. 1970 101 p refs
(Contracts DI-14-01-0001-814; DI-14-01-0001-989; DI-14-01-0001-1412; DI-14-01-0001-1864)
(PB-190268; TR-24) Avail: CFSTI CSCL 04B

Lysimeters of natural soil cores were constructed for field study of evaporation. A total of 9 lysimeters were constructed which were designed for either visual or recorded readout of data. Either the combination method of van Bavel or the Bowen Ratio will provide a fair estimate of evaporation from a wet soil surface in the area. In general, the combination method tends to overestimate while the Bowen Ratio tends to underestimate evaporation. This is due to the fact that the combination method places a strong emphasis on this parameter. The conductivity of the Olton loam soil is very low at fairly low soil water pressures corresponding to high contents. This is an asset in preventing evaporation losses, but may be deterimental to crop production in that the crops need to develop extensive root systems to use the stored soil moisture. Author (USGRDR)

N70-34269 National Lending Library for Science and Technology, Boston Spa (England).
THE LATE AND PROTRACTED SPRING
Ju. S. Petrovskij 24 Jun. 1970 7 p Transl. into ENGLISH from Priroda (Moscow), no. 8, 1969 p 124–125
(NLL-M-9228-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The meteorological conditions of the Northern Temperate Zone for the spring of 1969 are discussed. The late arrival, accompanied by severe rain and snow, followed by an intense cold spell resulted in flooding, crop damage, property damage, and many deaths. The cause is considered to have been an eastward shift of the troughs and ridges in the mid-troposphere, in early April, resulting in a warm flow into Eastern Europe, Western Siberia, and most of the USA. Rapid melting of snow occurred with flooding. These conditions were followed by a severe cold spell. F.O.S.

N70-34270 National Lending Library for Science and Technology, Boston Spa (England).
THE RELATION BETWEEN THE FREQUENCY OF MERIDIONAL FORMS OF ATMOSPHERIC CIRCULATION AND THE SUN'S CORPUSCULAR RADIATION
M. S. Bolotinskaja et al 24 Jun. 1970 8 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn.-Issled. Inst. (Leningrad), no. 31, 1969 p 31–35
(NLL-M-9229-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Solar activity is studied as a factor of atmospheric circulation by analyzing the influence of the 11-year solar activity cycle on zonal and meridional forms of circulation. The general conclusion is reached that the sun's corpuscular radiation has a definite effect on the frequency of meridional forms of circulation. F.O.S.

N70-34308# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
NACREOUS CLOUDS AT WHITE SANDS MISSILE RANGE
John M. Sharpe, Jr. Jan. 1970 25 p refs
(AD-705600; ECOM-5289) Avail: CFSTI CSCL 4/2

Observance of a rare cloud is described, and accompanying meteorological conditions are discussed. A photograph of the cloud and related data tabulations are presented. Author (TAB)

N70-34337# Allied Research Associates, Inc., Concord, Mass.
METEOROLOGICAL RELATIONSHIPS TO TROPOSPHERIC AND STRATOSPHERIC TURBIDITY PROFILES Final Report, 20 Jan. 1969–30 Apr. 1970
David T. Chang and Raymond Wexler Apr. 1970 31 p refs
(Contract F19628-69-C-0040)
(AD-705202; ARA-9G68-F; AFCRL-70-0197) Avail: CFSTI CSCL 4/1

The report completes the examination of 176 sets of data obtained with optical probing measurements in New Mexico. The study shows that: (1) A seasonal trend in the shape of the aerosol attenuation coefficient profile in the surface layer which is related to the strength of the diurnal surface convection; (2) the scavenging effects of precipitation are evident in the analysis of mid-tropospheric aerosol contents; (3) the relationship between the polar tropopause and upper tropospheric aerosol layer was less well defined in the data obtained during the latter part of 1965; (4) data from the latter part of 1965 support the findings that stratospheric aerosols have a tropical origin; and (5) the slow abatement of the Mt. Agung volcanic dust through 1965 is evident in changes in stratospheric optical thickness. Author (TAB)

N70-34338# Weather Wing (4th), Otis AFB, Mass.
TERMINAL FORECAST REFERENCE FILE, VOLUME 1
John Peschier and A. J. Gahan, eds. Mar. 1970 76 p
(AD-705201) Avail: CFSTI CSCL 4/2

The report describes the general and synoptic climatology of the local area at Otis AFB, Massachusetts. Seasonal weather regimes and their relationships to terminal weather conditions are described. The report serves as a useful guide to forecasters in the New England area. Author (TAB)

N70-34368# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
ATMOSPHERIC NEUTRAL-ELECTRICAL INTERACTIONS
Willis L. Webb Mar. 1970 26 p refs
(AD-705601; ECOM-5293) Avail: CFSTI CSCL 4/1

The global stratospheric circulation exhibits important perturbations shortly after equinox time which have been shown to be related to seasonal alterations of hemispheric geometries of the stratospheric tidal circulations based near 50 km altitude. Analysis has indicated that these same tidal circulations produce favorable conditions for noctilucent cloud formation and generate electromotive forces which motivate dynamo currents of the 100 km region. Comparisons presented here of the annual course of Sq magnetic field intensity, noctilucent cloud activity and stratospheric circulation intensity provide confirmation that these phenomena are directly related. The nature of this relationship is considered, and the implications of this mode of neutral-electrical interaction are discussed. Author (TAB)

N70-34402# Weather Wing (1st), San Francisco, Calif.
MAY CLIMATE OF SOUTHEAST ASIA
Mar. 1970 66 p Revised *Its* Spec. Study 105-11/5-Rev
(AD-705569) Avail: CFSTI CSCL 4/2

This study is one of a revised series of publications dealing with the climate of Southeast Asia on a monthly basis. For the purpose of this study, Southeast Asia is defined as North Vietnam, Republic of Vietnam, Laos, Cambodia and Thailand. The format has been organized in an effort to provide ready reference material to meet a variety of requirements for different users; however, information contained in this publication is based on climatic averages and should not be construed as a forecast. Conclusions drawn from isoline charts occasionally appear in conflict with, or unsubstantiated by, reported station values. This situation arises frequently in those areas lacking adequate station data, where isoline analyses were based wholly or in part on information other than actual station values. Further interpretation of data contained in this study should be made by a qualified Meteorologist. Author (TAB)

N70-34439*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANTICYCLONIC AND CYCLONIC EDDIES NEAR THE SOMALI COAST
Karl-Heinz Szekielda Jul. 1970 11 p refs Submitted for publication
(NASA-TM-X-63987; X-651-70-265) Avail: CFSTI CSCL 04B

Infrared analyses from measurements aboard the Nimbus 2 satellite showed a complex pattern of temperatures near the Somali Coast where upwelling appears during the Southwest monsoon. The patchiness of higher and lower temperatures may be explained by cyclonic and anticyclonic water movements. This statement is confirmed by ship observations. Author

N70-34543 National Lending Library for Science and Technology, Boston Spa (England).
WIND AND CLOUDS AT SUNRISE
N. I. Novozilov 9 Apr. 1970 6 p Transl. into ENGLISH from Priroda (Moscow), no. 3, 1969 p 69-70
(NLL-M-9102-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The inversion of temperature is a phenomenon occurring at dawn in the lower layers of the atmosphere. The formation of rotating cloud billows associated with it and also occurring at sunrise was observed and described. S.S.

N70-34755 National Lending Library for Science and Technology, Boston Spa (England).
THE RELATIONSHIP BETWEEN THE NUMBER OF LIGHTENING DISCHARGES AND THE SYNOPTIC SITUATION
V. A. Kamyshanova 9 Apr. 1970 5 p Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 225, 1968 p 16-18
(NLL-M-9101-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Lightening counters can assist in forecasting and assessing the thunderstorm activity in a given region by comparing the number of discharges with the synoptic charts. Thunderstorms appearing on the synoptic charts almost always mean a sharp increase in the number of atmospherics, whereas on some days there are a lot of atmospherics, but no thunder on the charts. Locations for the counters and some measurements have been taken. S.S.

N70-34782 National Lending Library for Science and Technology, Boston Spa (England).
SOME REGULARITIES IN THE DIURNAL AND ANNUAL VARIATIONS OF THE RADIATION BALANCE
S. Lingova 8 Apr. 1970 8 p refs Transl. into ENGLISH from Magy. Met. Tars. Foly., Idoj. (Hungary), 73, 1969 p 76-80
(NLL-M-9079-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Diurnal and annual variations of the radiation balance were considered using actinometric observations. The variation of the radiation balance was considered when the sky was clear, when the variation was most marked, and when there was cloud. Other investigations were made in average cloudiness conditions and when more of the sky was covered by clouds, that is when the cloudiness was eight tenths or more and the sun's disc was covered by clouds. To show the significance of the state of the sun's disc for radiation purposes, cases in which the sky was cloudy but the sun was not were studied. S.S.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-33584# Martin Co., Baltimore, Md.
FLIGHT TEST AND EVALUATION OF AIRBORNE COLLISION AVOIDANCE SYSTEM, VOLUME 2 Final Report
Apr. 1970 387 p refs Supported in part by the Air Transport Assoc. of Am.
(AD-705531; ER-14907-Vol-2) Avail: CFSTI CSCL 17/7

The volume provides a technical description of the Collision Avoidance System (CAS) hardware, the flight test instrumentation, the computer programs, the test facilities and a data inventory. A detailed description of the instrumentation and data processing, including the instrumentation schematics and the IBM 360 computer program, is presented to provide thorough understanding of the flight test results. Author (TAB)

N70-33635# Institute for Telecommunication Sciences, Boulder, Colo.
INTERFERENCE PREDICTIONS FOR VHF/UHF AIR NAVIGATION AIDS
G. D. Gierhart and M. E. Johnson Nov. 1969 64 p refs
(Contract FA-68-WAI-145)
(AD-701163; ESSA-ERL-138-ITS-95) Avail: SOD $0.60 CSCL 17/7

Desired-to-undesired signal ratio predictions for the VHF Omnirange VOR and Instrument Landing System ILS air navigation aids are presented. The parameters involved in these systems are given first. Propagation mechanisms applicable to VHF/UHF and the calculation of transmission loss and its variability are then discussed, and third, the statistical nature of the desired-to-undesired signal ratio predictions is explained. The results of the study, presented in graphical form, supplement those given by the authors in an earlier ESSA Technical Report on the same subject. In addition to extending the range of variables previously considered, this report considers the glide slope portion of the ILS. Author (TAB)

N70-33644# Ohio Univ., Athens. Dept. of Electrical Engineering.
VOR PROPAGATION AND STABILITY STUDY Final Report, Feb. 1967 - Dec. 1969
Richard H. Mc Farland, Fred Kiko, and G. E. Smith Jan. 1970 271 p refs
(Contract FA-67-WA-1721)
(AD-705079; EER-11-3; FAA-RD-69-44) Avail: CFSTI CSCL 17/7

Results of a theoretical and experimental investigation of propagation effects on VOR course accuracies and stability are presented. Fixed point measurements show propagation errors to be minimal, less than 0.2 degree with a two sigma probability. Effects of VOR receivers, meteorological fronts, tropospheric ducts, vertical polarization, and multipath due to aircraft, on course accuracy are identified and discussed. Evidence gathered from this research clearly indicates that the receiver is the major contributor to indicated course error and when this condition is improved, a factor of five improvement in VOR system accuracy can be available. Thus, the VOR has the potential for providing the increased navigational capability needed for a more dense airway structure for use in an area navigation concept. Special experiments were conducted using conventional and doppler-type VORs as well as a VOT to determine the effect of overflying aircraft on the course information presented in a user aircraft. Results show that the receiver design is critical in determining the magnitude of the perturbation that results. Data from long term, line-of-sight monitoring, accomplished at a range of 40 miles has been reduced and discussions of the identification and classification of significant course errors produced by propagation are provided. Laboratory simulation of propagation and other spurious effects is shown to be one means of aiding in receiver redesign to minimize the receiver response to such signals. Author (TAB)

N70-33674# Martin Co., Baltimore, Md.
FLIGHT TEST AND EVALUATION OF AIRBORNE COLLISION AVOIDANCE SYSTEMS Summary Report
20 Mar. 1970 39 p Supported in part by the Air Transport Assoc. of Am.
(AD-705529) Avail: CFSTI CSCL 17/7

Contents: Aircraft used in program; Instrumentation; Cockpit displays; Airspace protection envelopes; Tau zone boundaries; Final 60 seconds of countdown to intercept; Range alarms at low rates of closure; Aircraft separation at minimum range; Operational results; and Technical results. TAB

N70-33686# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
APPLICATION OF SUMMATION PROCEDURE BEFORE DEMODULATION FOR INCREASED SENSITIVITY OF AUTOMATIC LARGE-BASE DOPPLER DIRECTION FINDER [ZUR EMPFINDLICHKEITSSTEIGERUNG AUTOMATISCHER GROSSBASIS-DOPPLER-PEILER DURCH EINSATZ DES SUMMATIONSVERFAHRENS VOR DER DEMODULATION]
Hans-Christoph Hoering (Ph.D. Thesis) 4 Mar. 1970 161 p refs In GERMAN
Avail: CFSTI

The sensitivity of existing large-base Doppler direction finders is increased to encompass VHF and the UHF regions without changes in the input circuit of the system. Assumed was the predominance of internal noise over outside noise. Considered is an n-path filter before the demodulation step of the Doppler finder that uses an additional receiver and special compensation mixer to produce an intermediate frequency signal which depends only on the frequency of a heterodyne oscillator and not on the frequency of the received signal. Synchronization of the produced signal carrier frequency, rotation frequency of the direction-finding antenna, and summator running time produces signal lines concurring with median band frequencies of the filter band-path width. Optimal signal-to-noise ratios obtained with this summator reached 20 dB so that narrow band sensitivity increased to 12.5 dB. Transl. by G.G.

N70-33717# Martin Co., Baltimore, Md.
FLIGHT TEST AND EVALUATION OF AIRBORNE COLLISION AVOIDANCE SYSTEM, VOLUME 1 Final Report, 15 Jul.-20 Mar. 1970
326 p refs Supported in part by the Air Transport Assoc. of Am.
(AD-705530; ER-14907-Vol-1) Avail: CFSTI CSCL 17/7

The report presents an evaluation of a time-frequency/collision avoidance system. The report is in two volumes, which contain a description of the Collision Avoidance System hardware, methods of testing, data acquisition techniques, analyses of data and a presentation of the resulting Collision Avoidance System performance. From the report it can be seen that the concept is valid, that the equipment under test did provide suitable warnings and commands to pilots, and that these warnings and commands led to the safe avoidance of potential mid-air collisions. Author (TAB)

N70-33980*# Sperry Rand Research Center, Sudbury, Mass.
STRAPDOWN INERTIAL MEASUREMENT UNIT COMPUTER, VOLUME 1 Final Report
A. James Lincoln, Paul Carpenter, and Robert E. Oleksiak Oct. 1969 66 p
(Contract NAS9-8123)
(NASA-CR-108428) Avail: CFSTI CSCL 17G

A specialized breadboard computer to perform the angular transformations associated with a strapdown inertial measurement unit was designed and constructed. The overall functions performed by the system are described, and the methods used in performing various calculations within the computer are discussed. The calculations include direction cosines, velocity resolution, earth rate compensation, and Euler angles. The hardware implementation and operation instructions are outlined, and a method for updating direction cosines in a strapdown inertial guidance system is appended. N.E.N.

N70-34061# Radio Corp. of America, New York.
ATTITUDE REFERENCE DEVICE
Nigel Nathan 1970 7 p
(Grant NSF GA-1298)
(PB-190178) Avail: CFSTI CSCL 01D

The use of the described self-contained optical measurement unit operating in conjunction with reference mirrors at the IMU and gust probe appears to provide a practical means of solving the relative attitude problem to the desired accuracy. The lack of knowledge about the exact behavior of the mast in flight precludes any more detailed design. Author (USGRDR)

N70-34167*# Marquette Univ., Milwaukee, Wis.
ANALYSIS OF LIMITED MEMORY ESTIMATORS AND THEIR APPLICATION TO SPACECRAFT ATTITUDE DETERMINATION
Edwin C. Foudriat Washington NASA Aug. 1970 84 p refs
(Grant NGR-50-001-009)
(NASA-CR-1654) Avail: CFSTI CSCL 17G

A comparison study of the problem of estimating the attitude of a spin stabilized satellite in an earth's field environment has been made employing four types of optimal sequential filters. These include the nonlinear Kalman filter, and the Schmidt gain, nose added, and least-squares nonlinear limited memory filter systems. The limited memory concept is applicable to this problem since random disturbances on the satellite are negligible. The study indicates that all limited memory types give improved accuracy estimates over the Kalman filter. For the Schmidt gain and noise added, the magnitude of the additional terms included to improve filter performance are a compromise between good accuracy and convergence, since the convergence for these filters is degraded from the Kalman filter. In addition, the noise added system requires trial and error to determine the magnitude of the noise covariance terms needed. The least-squares limited memory filter is made practical by using a set of approximate equations in order to obtain rapid extrapolation of the state and state transition equations. This sytem which employs more than one measurement in processing is shown to improve both convergence and accuracy over the Kalman filter. Author

N70-34203# Army Electronics Command, Fort Monmouth, N.J. Avionics Lab.
A DOPPLER INERTIAL INVESTIGATION
Irving Levine and Carl J. Galanti Mar. 1970 58 p refs
(AD-705256; ECOM-3247) Avail: CFSTI CSCL 17/7

An error analysis of a hybrid doppler-inertial system (second order) was performed with an without noise error sources. From this analysis it was determined that the doppler is the key contributor to the velocity error of the system. Also, a procedure for selecting the parameters of a doppler-inertial system for minimum cost and maximum performance was derived. (Author) TAB

N70-34218*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE COMBINED EFFECT OF GRAVITY GRADIENT AND AERODYNAMIC TORQUES ON THE ATTITUDE CONTROL OF THE APOLLO/S-4B IN A CIRCULAR ORBIT ABOUT THE EARTH
Kenneth L. Lindsay 14 Feb. 1964 61 p refs *Its* Program Apollo Working Paper No. 1107
(NASA-TM-X-64300) Avail: CFSTI CSCL 17G

An analysis of the combined effect of aerodynamic and gravity gradient torques on the attitude control of the Apollo/S-4B configuration during the earth parking orbit phase of a lunar landing mission is described. Aerodynamic torques are determined by means of free molecule impact theory, commonly referred to as specular reflection. The equations utilized in the analysis were programed on the IBM 7094 computer using an assumed orbit altitude of 100 nautical miles. The effects of the disturbance torques on the limit cycle characteristics of the vehicle were determined using the S-4B attitude control system to maintain the vehicle at various pitch, yaw, and roll attitudes relative to the local horizontal within specified deadbands. Pure pitch attitudes of 0, 45, and 90 degrees relative to the local horizontal were simulated using specified deadbands varying from + or − 0.5 degrees to + or − 5 degrees. At all commanded attitudes, the vehicle damped to a steady state limit cycle on one side of the pitch deadband instead of traversing the entire deadband as desired. The frequencies of these limit cycles were considerably higher than those which would exist in the absence of disturbing torques, resulting in increased control system fuel consumption. Author

N70-34238*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROJECT APOLLO: ANALYSIS OF LANDING POINT DESIGNATOR OPERATION
Donald C. Cheatham and David E. Steele 9 Dec. 1965 18 p refs
(NASA-TM-X-64312; MSC-65-EG-52) Avail: CFSTI CSCL 17G

The Landing Point Designator (LPD) operation, for lunar site accuracy, was analyzed with an aim of determining the trade-off between required accuracy, number of redesignation corrections, and fuel penalty. The analysis indicates that: (1) the fuel penalties associated with LPD errors of the order of 1/2 degree are reasonable provided that the logic for the initial LPD application is biased to the positive side of the target area; (2) the number of redesignations associated with a 1/2 degree LPD is about four, depending upon the altitude of the first redesignation; and (3) the 1/2 degree increment associated with LPD updates is believed to be an acceptable compromise between resolution of target designation, number of refinements, and final touchdown point accuracy. D.L.G.

N70-34255# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
SRDS PROGRAM: GOALS, ACHIEVEMENTS, TRENDS, 1 APRIL 1969 – 31 MARCH 1970
31 Mar. 1970 155 p
(AD-704475) Avail: CFSTI CSCL 17/7

Contents: Air traffic control activity; Navigation; and Aviation weather. TAB

N70-34257# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF DRY FRICTION FORCES IN GYROSCOPE PRECESSION AXES ON THE MOTION OF THE SENSING ELEMENT OF A GYROCOMPASS
V. N. Koshlyakov et al 26 Mar. 1970 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Tverdogo Tela (Moscow), no. 1, 1969 p 35–39
(AD-705242; FTD-HT-23-173-70) Avail: CFSTI CSCL 17/7

Investigation of the effect of the moment of the dry friction forces in the bearings of gyroscope casings on the motion of the sensing element of a double-rotor gyrocompass. The equations for the deviations of the azimuth and the angle of elevation of the north end of the gyrosphere above the horizon level, arising from dry friction in the precession axes of the gyroscopes, are presented. It is shown that at high latitudes, where the value of the directional moment of a gyrocompass decreases appreciably, dry friction can essentially diminish the accuracy of the device. Author (TAB)

N70-34278*# General Electric Co., Philadelphia, Pa.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE. VOLUME 1: SYSTEM SOFTWARE AND ANALYSIS Final Technical Report
31 Mar. 1970 584 p refs
(Contract NAS5-9042)
(NASA-CR-109893; DOC-69SD4372-Vol-1) Avail: CFSTI HC $10.00/MF $0.65 CSCL 17G

Gravity gradient stabilization systems were developed for three Applications Technology Satellites and flight analysis and data reduction support were provided when each system was flown. Each gravity gradient system included a set of motor-driven, extendable/retractable primary booms and tip masses which could be scissored in orbit to change the geometry of the deployed-boom configuration. System design, development, test, and flight analysis are summarized. This volume contains the background analysis which established the basic hardware parameters and performance estimates and provided estimates of performance variations due to design modifications. A description of software is also given. Volume 2 contains a summary of the engineering effort associated with the development and testing of each subsystem and includes a description of the hardware requirements and assumptions. Author

N70-34277*# General Electric Co., Philadelphia, Pa.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE. VOLUME 2, BOOK 1: HARDWARE DEVELOPMENT AND TEST Final Technical Report
15 Jan. 1970 202 p refs
(Contract NAS5-9042)
(NASA-CR-109898; DOC-69SD4372-Vol-2-Bk-1) Avail: CFSTI CSCL 17G

For abstract see N70-34276.

N70-34278*# General Electric Co., Philadelphia, Pa.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE. VOLUME 2, BOOK 2: HARDWARE DEVELOPMENT AND TEST Final Technical Report
15 Jan. 1970 241 p refs
(Contract NAS5-9042)
(NASA-CR-109899; DOC-69SD4372-Vol-2-Bk-2) Avail: CFSTI CSCL 17G

For abstract see N70-34276.

N70-34292# Naval Postgraduate School, Monterey, Calif.
A SIMPLIFIED, CW, RANDOM NOISE RADAR SYSTEM
Frank Durat (M.S. Thesis) Oct. 1969 29 p refs
(AD-701678) Avail: CFSTI CSCL 17/7

Experiments with a CW, random-noise, X-band, radar ranging system are presented, following the technique proposed and used by G. L. Poirier. The correlation signal-processing method differs from that of other noise radars in that no delay lines are required. The signal-processing technique also decorrelates clutter and other interference, including the transmitted signals of other radar systems identical except for their statistically independent noise sources. An application to small-vessel navigation systems is proposed. Other applications in communications and jamming systems are considered. The experiments verify a ranging accuracy of 1.45 meters at a range of 154 meters. The range capability extends from a minimum of 30 meters to the radar horizon at 19,000 meters in the system constructed. The minimum range and accuracy capabilities exceed those of existing pulsed radars installed in small craft. Possible solid-state implementations using currently available devices are outlined. Proposals for future experiments are made, including shortening of minimum range by increasing transmitted bandwidth, and increasing accuracy by refinement of the laboratory model. Author (TAB)

N70-34295* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DYNAMIC PRECESSION DAMPER FOR SPIN STABILIZED VEHICLES Patent
Howell D. Garner and Henry J. E. Reid, Jr., inventors (to NASA) Issued 15 Jun. 1965 (filed 27 Aug. 1963) 6 p Cl. 244-1
(NASA-Case-XLA-01989; US-Patent-3,189,299; US-Patent-Appl-SN-305020) Avail: US Patent Office CSCL 17G

Two different arrangements are described for dynamic precession damping. The first provides a rate gyroscope which produces an output proportional to the angular velocity of the spin-stabilized vehicle about the sensitive axis of the rate gyroscope. The output from the gyroscope is modified by a threshold device and then applied to a torque producing device which has a torque axis parallel to the sensitive axis of the gyroscope. The torque device generates a torque about the sensitive axis which decreases the amplitude of the precessional motion of the vehicle. The second configuration provides an angular accelerometer which operates in a manner similar to that of the rate gyroscope. R.B.

N70-34297* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR DETERMINING SATELLITE ORIENTATION UTILIZING SPATIAL ENERGY SOURCES Patent
Elden C. Whipple, Jr., inventor (to NASA) Issued 8 Jun. 1965 (Filed 12 Jul. 1961) 12 p Cl. 250-83.3
(NASA-Case-XGS-00466; US-Patent-3,188,472; US-Patent-Appl-SN-123597) Avail: US Patent Office CSCL 17G

A sensing method and device are described for determining the orientation of a space vehicle or satellite. The method is designed to determine the orientation of a satellite traversing a known orbit at a known position when the satellite is within the shadow of the earth or exposed to solar radiation. The device employs a group of particle traps sensitive to the impingement of either charged particles or light radiation. The particle traps are placed at different positions on the surface of the satellite and determine its aspect angles in spatial coordinates. R.B.

N70-34300*# Applied Information Industries, Moorestown, N.J.
L-BAND ATS 5/ORION/S. S. MANHATTAN MARINE NAVIGATION AND COMMUNICATION EXPERIMENT Final Report
O. J. Hanas, M. E. Illikainen, D. L. Kratzer, and E. A. Spaans Jun. 1970 150 p
(Contract NAS12-2260)
(NASA-CR-109877) Avail: CFSTI CSCL 17G

A unique experiment is described in which L-band signals relayed by synchronous satellite were successfully used for navigation and data communication. RF signals containing ranging modulation were transmitted from NASA's STADAN Station at Mojave, California, relayed through the ATS-5 synchronous satellite and received by two stations. One was stationary, located in Moorestown, New Jersey, and the other was marine mobile. The feasibility of position fixing was demonstrated by making range measurements between a fixed ground station, a satellite in a known position, and a moving platform on the surface of the earth. The simultaneous transmission and reception of data communications on the ranging signal is also noted. The results and conclusions are described in terms of carrier-to-noise ratios of the signal, the precision of the system, a relative comparison of accuracy, the effects attributed to multipath and the quality of data transmission. Author

N70-34326*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
VERIFICATION OF ENTRY MONITOR SYSTEM LINE PATTERNS: PROJECT APOLLO
Randal H. Lefler 14 Mar. 1969 69 p refs
(NASA-TM-X-64307) Avail: CFSTI CSCL 17G

An examination has been conducted of procedures and data which relate to the derivation of the EMS (entry monitor

system) flight limit lines and range guidelines for the two types of lunar return scroll patterns (3500 n mi and non-exit). Data were checked to insure consistency throughout the development of each set of lines. One error was found in the development of the 75 n mi range guideline. The error caused this guideline to represent a range incorrect by two to four nautical miles for levels of G between G = 2.5 and G = 3.0, and between G = 7.0 and G = 8.0. In an actual entry, this small error would be accounted for as the 50 n mi range guideline, which was correctly derived, was approached so that the error did not represent a serious compromise with the EMS backup ranging capability. No other errors or inconsistencies were found. It was concluded that the flight limit lines and the range guidelines, with the one exception mentioned above, were correctly developed and were valid for all applicable flight conditions for Apollo entries. Author

N70-34344*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SIMULATION STUDY OF MANUAL CONTROL TECHNIQUES FOR LUNAR ORBIT RENDEZVOUS

Ronald W. Simpson, Paul J. Stull, Ronald L. Wyrick, James R. Brickel, Dean F. Grimm et al 2 Aug. 1965 65 p

(NASA-TM-X-64342; MSC-65-EG-33) Avail: CFSTI CSCL 17G

A hybrid simulation of manual control of the terminal phase of lunar orbit rendezvous was conducted. The rendezvous was simulated in six degrees of freedom using two analog computers, a fixed-base simulator, and a digital differential analyzer. The fixed-base simulator contained the pilot controls and instrument displays. Rendezvous of the pilot controlled LEM spacecraft with an orbiting CSM spacecraft was performed from five typical LEM/CSM intercept and miss trajectories. Six different thrusting techniques were evaluated for each trajectory. The techniques differed with respect to the criteria used for LOS rate control and thrusting procedures. The quantities displayed to the pilot were relative range between the two spacecrafts, relative range-rate, LOS angles between the spacecrafts, and LOS angular rate. The performance of the recommended manual thrusting technique was compared with that of the automatic primary guidance mode (PNGS). This comparison indicated the manual technique requires about 30% more delta V than the PNGS. Thrusting schedules for both the manual technique and the PNGS are recommended. Author

N70-34351*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

INVESTIGATION OF LANDING SITE REDESIGNATION DURING PHASE 2 OF THE LEM POWERED DESCENT USING PRIMARY GUIDANCE

Thomas G. Price 19 Jul. 1965 29 p refs Apollo Program Working Paper No. 1180

(NASA-TM-X-64341) Avail: CFSTI CSCL 17G

A study is presented of the required guidance commands and available footprint for landing site redesignation during the final approach phase (phase 2) of the LEM powered descent. Redesignations are initiated between 11,000 and 5,000 feet altitude off a nominal descent trajectory. The study, based on a fixed time-to-go, indicates that a nearly circular footprint of about 10,000 to 20,000 ft radius is available for a delta V penalty of 100 fps. Since the time-to-go is held constant at the value predicted by the guidance logic for the nominal trajectory, the alternate site selection destroys the constancy of the guidance commands for the nominal phase 2 flight. These command variations, in some instances, cause interruptions in the visibility of the landing area and also produce command rates near design control limits. Author

N70-34378*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

LINEAR ACCELERATION GUIDANCE FOR LUNAR LANDING AND LAUNCH TRAJECTORIES

Victor R. Bond 28 Aug. 1963 35 p refs Program Apollo Working Paper No. 1087

(NASA-TM-X-64298) Avail: CFSTI CSCL 17G

An approximate analytical solution to the problem of maneuvering a spacecraft to reach specified end conditions by finite thrusting in the vicinity of the moon is presented. The analysis includes all three dimensions and the acceleration terms in the equations are linearized. The examples presented are limited to the planar case. Although in general the thrusting scheme is variable, a constraining relation is introduced to allow burning time for constant thrust to be calculated. Similarly, a constraining relation may be introduced which allows a burning time for a constant thrust angle to be calculated. The solution is versatile in that it allows variable thrust, constant thrust, and constant thrust angle trajectories between specified end conditions. Author

N70-34438*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

EFFECT OF TERRAIN VARIATIONS ON PRIMARY LEM GUIDANCE EQUATIONS DURING PHASE 2 OF POWERED DESCENT

Floyd V. Bennett 21 Dec. 1964 19 p refs Program Apollo Working Paper No. 1148

(NASA-TM-X-64338) Avail: CFSTI CSCL 17G

The landing radar is used to measure the altitude above the lunar terrain in order to update the primary guidance system during the landing approach portion (Phase II) of the LEM powered descent to the lunar surface. The effects of variations in the lunar terrain on the guidance commands is investigated. Two lunar models are considered: (1) a linear variation or constant slope, and (2) a step function variation. In general, it was found that these variations destroy the constancy of the guidance commands nominally desired in this phase of flight. Compensation for abrupt changes in the terrain required abrupt changes in the guidance commands. Compensation for a sloping terrain required abrupt changes in commands near the end of flight. Furthermore, these radical changes in guidance commands were shown to cause interruptions in the pilot's visual assessment of the landing area. No appreciable fuel penalty was found. Author

N70-34513*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

NAVIGATIONAL CAPABILITIES OF THE SEXTANT AND RANGING DEVICE FOR CSM-ACTIVE RENDEZVOUS

Jack H. Shreffler 18 Jan. 1968 24 p refs

(NASA-TM-X-64386; MSC-68-FM-17) Avail: CFSTI CSCL 17G

Navigation error analysis results which are used to evaluate the navigational capabilities of the sextant, the ranging device, and the two in combination in the interval between CDH and TPI are presented. It was concluded that: (1) The sextant's ability to refine relative state uncertainties increases slightly the coelliptic phase. (2) The sextant may be used as a navigational instrument to determine relative state uncertainties to within 60 n. mi. and 435 fps after 15 minutes of tracking. (3) The sextant's navigational capability is primarily based on establishing correlations between the in-plane orbital elements which tends to reduce uncertainties upon propagation. (4) The ranging device and the ranging device with the sextant both have the ability to determine the relative state to within 0.75 n. mi. and 7.5 fps after 15 minutes of tracking. Author

N70-34528*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

BASIC EQUATIONS AND LOGIC FOR THE REAL-TIME GROUND NAVIGATION PROGRAM FOR THE APOLLO LUNAR LANDING MISSION: PROJECT APOLLO

Emil R. Schiesser, Howard G. de Vezin, Robert T. Savely, and

Michael J. Oles 15 Apr. 1968 239 p refs
(NASA-TM-X-64348; MSC-68-FM-100) Avail: CFSTI CSCL 17G

The basic equations, logic, operating controls, and displays to be used for the Apollo lunar landing mission real-time ground navigation program are presented in this document. The main part of the real-time ground navigation program will determine the orbit of a single vehicle. The program will be called twice when it is necessary to determine two orbits during the same phase of the mission. The supervisory part of the program will keep track of all constants and data peculiar to each vehicle. The program employs a typical weighted least squares method in which a weight is given to the previously computed estimate of the vehicle's position and velocity as well as the observational data. The vehicle position and velocity vectors to be corrected will be in the reference body system associated with the anchor vector. The anchor vector will be at the time of the first observation in the batch of data to be processed. Position and velocity will be computed with the current powered-flight polynomial fit program during launch and, when necessary, for earth orbit burns. Author

N70-34537*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MAXIMUM ALLOWABLE LATERAL VELOCITY ERRORS DURING LM POWERED DESCENT: Program Apollo
Gene Mc Swain 1 Sep. 1967 15 p ref
(NASA-TM-X-64383; MSC-67-EG-27) Avail: CFSTI CSCL 17G

A study has been conducted using a LM Digital Powered Descent Simulation Program to determine the magnitude of lateral velocity error which can be tolerated by the LM descent guidance system. The large lateral velocity errors studied are not velocities which are anticipated but rather are velocities which, if encountered, may affect the functioning of the landing radar updating of the guidance and navigation process. The study showed that a satisfactory descent was obtained for a lateral velocity error of 200 ft/sec even though radar data dropped out for 12 seconds after the second update because of the resulting pilot roll angle of nearly 50 deg. For a 150 ft/sec error, no radar dropout occurred. The study also revealed that landing site visibility for lateral velocity errors as large as 100 ft/sec closely approximated the nominal descent visibility. Author

N70-34539* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATTITUDE AND PROPELLANT FLOW CONTROL SYSTEM AND METHOD Patent
W. J. D. Escher, inventor (to NASA) Issued 25 Dec. 1962 (filed 20 Mar. 1961) 7 p Cl. 244-76
(NASA-Case-XMF-00185; US-Patent-3,070,330; US-Patent-Appl-SN-97112) Avail: US Patent Office CSCL 17G

A method of providing thrust vector positioning, three-axis control, integrated vehicle orientation and propellant flow control, and thrust level programming and propellant mixture ratio control for liquid propellant rocket vehicles is described. A rearward symmetric assembly of two pairs of thrust chambers has each pair diametrically opposed and canted in opposite directions to produce equal moments about the center of gravity in either the yaw or pitch roll planes. Sensing apparatus develops individual error signals correlative to the magnitude of vehicular orientation disturbances and flow control valves for each chamber respond to the error signals. Programming and sensing devices control propellant flow according to desired magnitude of thrust level, instantaneous mixture ration ratio, and the needs of start and shut-down transient periods. N.E.N.

N70-34580*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FALSE HIGH GATE TARGETING FOR LM POWERED DESCENT
G. Gene Mc Swain and Thomas E. Moore 27 May 1968 31 p refs
(NASA-TM-X-64346; MSC-68-EG-07) Avail: CFSTI CSCL 17G

This report presents false high gate targeting (FHGT), a technique to reduce the sensitivity of the LM descent guidance system to radar altitude updates. Guidance sensitivity is reduced by using a false target which adds a bias time of 60 seconds to the time-to-go to the high gate aim point. FHGT allows the LM state vector to be updated with landing radar using the presently established radar weighting functions but reduces the reaction of the guidance system to large updates. Thus, navigation errors are removed without permitting the guidance system to closely follow fluctuations in terrain. Author

N70-34581*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RTCC REQUIREMENTS FOR MISSION G: SELECTING AND VERIFYING USBS DOPPLER DATA SOURCES DURING LM ASCENT AND DESCENT
Alan D. Wylie 30 Apr. 1968 67 p refs
(NASA-TM-X-64345; MSC-68-FM-105) Avail: CFSTI CSCL 17G

A program for computing MSFN high-speed Doppler tracking residuals uses the real time computer complex for verifying and selecting USBS Doppler data sources during LM ascent and descent. These same residuals are used to determine whether the primary guidance and navigation control system (PGNCS) or the abort guidance system (AGS) is the more correct LM navigation system if the two significantly disagree. Rendezvous radar observations are also processed to compute rendezvous radar residuals which provide an independent test on the accuracy of PGNCS versus AGS. The program has the capability of simultaneously processing nondestruct Doppler data for up to four USBS ground stations tracking the LM during ascent and descent, one of which may be the transmitter. It is assumed that the Doppler biases for these stations have been computed. In order to check the validity of the ground tracking data, Doppler residuals are computed for each tracker using common telemetered LM state vectors from either PGNCS or AGS. Author

N70-34602*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LM LANDING POINT DESIGNATOR PROCEDURES AND CAPABILITY: PROGRAM APOLLO
Jay D. Montgomery and Randal H. Lefler 1 Aug. 1967 16 p refs
(NASA-TM-X-64352; MSC-67-EG-24) Avail: CFSTI CSCL 17G

The capabilities and procedures associated with the landing point designator are discussed and a final approach redesignation logic is formulated in order that a desirable landing area may be achieved by the LM. Specific procedures are outlined, and an example case of the LM's capability is discussed. Author

N70-34606*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PERFORMANCE OF APOLLO BLOCK 2 THRUST VECTOR CONTROL USING THE PGNCS (PRIMARY GUIDANCE NAVIGATION AND CONTROL SYSTEM): PROJECT APOLLO
Emery E. Smith, Jr. 8 Apr. 1969 29 p refs
(NASA-TM-X-64369; MSC-69-EG-18) Avail: CFSTI CSCL 17G

Developed was an all digital functional simulator of the Apollo block II TVC (thrust vector control), during SPS (service propulsion system) thrusting, including combined guidance and digital autopilot dynamics. These functional simulators have been used as design and analysis tools and provide detailed performance data. This report presents the results of a performance analysis comparison of the COLOSSUS 1 and COLOSSUS 2 TVC DAP designs using these simulators. Alternate designs for the COLOSSUS 2 program were also evaluated. The primary effort of the study was

concentrated on the CSM/LM configuration as the CSM DAP is identical for both programs and has already been flight tested. The results of this study showed that: (1) the COLOSSUS 2 design gives far superior performance and is adequate for the lunar mission; (2) one of the three alternate designs for COLOSSUS 2 is unacceptable because of unstable propellant dynamics; and (3) the other two alternate designs are adequate. Author

N70-34624*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

A PRELIMINARY ANALYSIS OF FAILURE DETECTION AND GUIDANCE SYSTEM MONITORING DURING THE LM POWERED DESCENT

Clarke T. Hackler 29 Jun. 1966 28 p refs

(NASA-TM-X-64360; MSC-66-EG-32) Avail: CFSTI CSCL 17G

An analysis of the primary navigation and guidance system and abort guidance system guidance failures and their effect on the powered descent trajectory has been made. The critical failures have been identified and the probability of their detection by the crew determined. Failed system isolation using the manned space flight network and landing radar is discussed. Finally, two possible methods for monitoring the onboard guidance systems are discussed and evaluated. Author

N70-34635*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

THE EFFECT OF RANGE CONSTRAINTS ON LM DESCENT GUIDANCE PERFORMANCE IN THE PRESENCE OF ENGINE THRUST UNCERTAINTIES

Thomas E. Moore 15 Nov. 1966 12 p ref

(NASA-TM-X-64359; MSC-66-EG-41) Avail: CFSTI CSCL 17G

A hybrid simulation study was conducted in which the performance of range-free and range-fixed LM descent guidance was compared for a descent engine thrust uncertainty of + or − 4%. The trajectory for the range-fixed guidance was designed for a + or − 2% thrust uncertainty (nominal throttling at 70 seconds). For the low thrust cases, the pilot used the LPD to adjust the trajectory after high gate. The performance characteristics considered in the comparison were the conditions achieved at high gate, the characteristic velocity, the visibility after high gate, and the landing site range dispersion. The results revealed that the trajectory does not need to be designed for the full range of thrust uncertainty for range-fixed guidance. Instead, pilot procedures can be established for redesignations after high gate using the LPD to provide a satisfactory visibility phase for the low thrust cases. For a − 4% thrust LPD increments were required to avoid crashing. The additional pilot workload and delta V penalty of 125 ft/sec for either + or − 4% thrust leads to a recommendation for a range-free option in the LGC. Author

N70-34649*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

EVALUATION OF THE LM GUIDANCE SYSTEM PERFORMANCE OVER THE APPROACH TERRAIN OF FIVE OF THE PROPOSED APOLLO LANDING SITES: APOLLO PROGRAM

David A. Dyer 6 Mar. 1968 30 p refs

(NASA-TM-X-64381; MSC-68-EG-03) Avail: CFSTI CSCL 17G

A review of the evaluation status of the LM guidance system performance over approach terrain variations as of the March 1967 Apollo Site Selection Board briefing is presented. The development progress since the March briefing and a summary of the results of an evaluation of sites 2-P-2, 2-P-6, 2-P-8, 2-P-11, and 2-P-13 are presented. A brief outline of the continuing activity is also presented. Author

N70-34665*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO NAVIGATIONAL ACCURACY IN LUNAR ORBIT INCLUDING LANDMARK UPDATING

Victor R. Bond and Anne D. Modisette 4 Jan. 1966 29 p refs

(NASA-TM-X-64347; MSC-66-EG-3) Avail: CFSTI CSCL 17G

The analytic description of an orbital navigation program that will simulate the estimation of position and velocity of an Apollo spacecraft while in orbit about the moon or the earth is presented. The inertial positions of a series of landmarks are observed and used as the navigational information, which is processed by linear filter theory techniques. The landmark positions are also estimated and their uncertainties in location are reduced. The program is applied to the problem of estimating the position and velocity of an Apollo spacecraft while in orbit about the moon. Using realistic initial values for the uncertainties in landmark positions, it is shown for a typical case that the RMS position and velocity estimation errors at lunar excursion module separation are about three times as high as the unrealistic, overoptimistic case of assuming perfectly known landmarks. The landmark estimation uncertainties are decreased by about two-thirds of their initial uncertainties. Author

N70-34673*# National Aeronautics and Space Administration. Manned Spaceflight Center, Houston, Tex.

USE OF THE RENDEZVOUS RADAR FOR GUIDANCE MONITORING AND FAILED GUIDANCE SYSTEM DETECTION DURING THE LM POWERED DESCENT

Clarke T. Hackler 22 Sep. 1966 8 p refs

(NASA-TM-X-64380; MSC-66-EG-42) Avail: CFSTI CSCL 17G

An analysis of the rendezvous radar as a guidance monitoring and failure detection and isolation device during powered descent is made. The results indicate the tracking radar is of little value to the crew in this respect, largely because of the tape indicator limitations and the large descent engine thrust uncertainties. Author

N70-34679*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

RANGEFINDER TESTS FOR THE D MISSION RENDEZVOUS: PROJECT APOLLO

Idulis Saulietis 28 Feb. 1969 20 p refs

(NASA-TM-X-64340; MSC-69-EG-7) Avail: CFSTI CSCL 17H

Three passive optical rangefinding devices were evaluated on an optical range, using the LM ascent stage as the target. Ranges of 4.0 to 0.6 n. mi. were evaluated. A training procedure was developed to attain the required 5% absolute accuracy goal. The D mission prime and backup command module pilots were trained in the use of the flight-type rangefinder. Test results are tabulated and evaluated. Author

N70-34682*# National Aeronautics and Space Administration. Manned Spaceflight Center, Houston, Tex.

CONSIDERATIONS IN LUNAR LANDMARK SIGHTING AND RECOMMENDED TECHNIQUES: PROJECT APOLLO

Edward H. Simon, Jr. 2 Feb. 1969 14 p refs

(NASA-TM-X-64355; MSC-69-EG-2) Avail: CFSTI CSCL 17G

Various aspects of optimum tracking techniques are discussed for the Apollo CSM-LM. The results include the following: (1) it appears that the optimum technique consists in rotating the CSM at orbital rate, with the scanning telescope (SCT) shaft axis about 30 deg ahead of the local vertical. Primary constraints include limitations on the SCT field of view and consideration of fuel economy, (2) choice of a set of 25 landmarks to be programmed for automatic acquisition is a function of the envelope of ground tracks and computer programs for their selection. They should be

chosen so there is an adequate interval to acquire each after the previous one has disappeared over the horizon, and there is a known relationship to the lunar landing site. Author

N70-34698*# National Aeronautics and Space Administration. Manned Spaceflight Center, Houston, Tex.
A SIMULATION STUDY OF ENTRY RANGING USING THE CM BLOCK 2 ENTRY MONITORING SYSTEM (EMS): PROJECT APOLLO
Clyde H. Paulk, Jr. and Herbert G. Patterson 25 Jan. 1967 95 p refs
(NASA-TM-X-64375; MSC-67-EG-10) Avail: CFSTI CSCL 17G

A piloted simulation of the CM Block II entry was conducted to evaluate the feasibility of using the entry monitor system (EMS) as a backup ranging device in the event of a primary G&N malfunction. The results of the study indicate that the addition of backup ranging lines on the EMS scroll provides the crew with the capability of maneuvering the spacecraft to a preselected landing site following a G&N failure. Simulation results indicated that there is an 89% probability that the spacecraft will land within 161 n. mi. of the mean miss distance (50 n. mi.) if the pilot uses the EMS backup mode for entry ranging. Author

N70-34704*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A STUDY OF LANDING RADAR ANTENNA SWITCHING: PROJECT APOLLO
David A. Dyer 27 Nov. 1968 7 p refs
(NASA-TM-X-64409; MSC-68-EG-16) Avail: CFSTI CSCL 17G

A study was made to determine the tradeoffs involved in defining a landing radar antenna switch point. A preliminary switch point for the one-phase guidance trajectory is presented. As the trajectory and/or radar changes, the switch point will be reevaluated. Author

N70-34706*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LM CONTROLLABILITY DURING DPS THRUSTING: PROJECT APOLLO
Henry J. G. Kaupp, Jr. 7 Dec. 1967 14 p
(NASA-TM-X-64394; MSC-67-EG-37) Avail: CFSTI CSCL 17G

In case of a failure in the gimbal trim system (GTS) of the LM descent propulsion system (DPS), or an erroneous GTS drive command from the LM digital autopilot (DAP) caused by noisy attitude measurements, or large initial LM c.g. uncertainty due to propellant transfer during coast, it is possible for the disturbance torque due to DPS thrust to exceed the control torque available from the reaction jet control system (RCS). Attempts to plot controllability boundaries are generally complicated by the fact that there are numerous time varying parameters, and that pitch and roll RCS torques are coupled. The LM controllability problem is discussed in a general sense, and a nomogram is presented that should be a useful tool for quick assessments of stability margins (or divergence rates) for specific cases. Author

N70-34715*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
QUICK LOOK RESULTS OF A SIMULATION STUDY OF ENTRY RANGING USING THE CM BLOCK 2 ENTRY MONITORING SYSTEM (EMS): PROJECT APOLLO
Herbert G. Patterson and Clyde H. Paulk, Jr. 6 Jul. 1968 35 p refs
(NASA-TM-X-64362; MSC-68-EG-33) Avail: CFSTI CSCL 17G

A piloted simulation of the CM Block 2 entry has been conducted to evaluate the feasibility of using the entry monitor system (EMS) as a backup ranging device in the event of a primary Guidance and Navigation (G&N) malfunction. The results of the study indicate that the addition of some backup ranging lines on the EMS scroll provides the crew with the capability of maneuvering the spacecraft to a preselected landing site following a G&N failure. Action has been taken to try and have these backup ranging lines included in the Block 2 CM series. Simulation results indicated that there is an 89% probability that the spacecraft will land within 161 n. mi. of the mean miss distance (50 n. mi.) if the pilot uses the EMS backup mode for entry ranging. Author

N70-34729*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SOME EFFECTS OF DESCENT ENGINE THROTTLE LOGIC AND INITIAL ALTITUDE ERRORS ON LANDING SITE VISIBILITY
Thomas E. Moore 4 Jan. 1967 14 p refs
(NASA-TM-X-64396; MSC-67-EG-01) Avail: CFSTI CSCL 17G

A number of runs performed on the MSC/GCD hybrid landing simulation are reviewed to determine some effects of descent engine throttling logic and initial altitude errors on post high gate landing site visibility. Two throttling logics were considered following the initial throttle down: (1) the engine thrust command was limited to a maximum value near 60%, or (2) the engine was returned to the 92.5% constant throttle if the LGC thrust command exceeded a certain value. The study indicated that during certain test conditions, logic (1) produced detrimental effects on post high gate visibility, and logic (2) produced thrust pulses that could be operationally undesirable disturbances. Author

N70-34737*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
STABILITY ANALYSIS OF APOLLO ATTITUDE CONTROL DURING SERVICE PROPULSION THRUSTING: PROJECT APOLLO
Bernard Marcantel 5 Mar. 1969 72 p refs
(NASA-TM-X-64413; MSC-69-EG-21) Avail: CFSTI CSCL 17G

Results of analysis for determining the nominal stability margins, of the thrusting flight attitude control system, for the Apollo CSM spacecraft are given. The stability margins are presented for both the pitch and yaw control channels, using both the Primary Guidance and Navigation System Digital autopilots and the Stabilization Control System analog autopilots. Analyses were performed for the spacecraft in the docked and undocked configurations, and for various SPS propellant load conditions in each configuration. Author

N70-34745*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
USE OF THE LANDING POINT DESIGNATOR TO LAND THE LUNAR MODULE TO A GIVEN TARGET: PROJECT APOLLO
Jerrold H. Suddath and Rudolph L. Saldana 14 Nov. 1967 18 p refs
(NASA-TM-X-64376; MSC-67-EG-32) Avail: CFSTI CSCL 17G

Some theoretical results pertaining to the problem of making efficient use of the landing point designator (LPD) to land the lunar module (LM) to a given target are presented. In particular, the question of how to bias the initial aim point so as to make the most effective use of the LPD is considered. The procedure for determining the initial aim point bias is presented along with example applications. Results are given in terms of the probability of reaching the target within the LPD Delta V budget. Author

N70-34749*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LM LANDING RADAR TEST FOR THE F MISSION: PROJECT APOLLO

David A. Dyer 11 Mar. 1969 13 p
(NASA-TM-X-64374; MSC-69-EG-14) Avail: CFSTI CSCL 17G

A LM landing radar test was defined for the F mission. This test, to take place between descent orbit insertion and the phasing burn should provide about 800 sec of data for beams one, two, and four, and 400 sec for beam three. The LM attitude requirements were also determined. This study was based on the average characteristics of four landing radars. The averages of measured power outputs, antenna gains, wave guide losses, and noise levels were used as input data to the GAEC math model. Author

N70-34760*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A SIMULATED STUDY OF MANUAL CONTROL TECHNIQUES FOR THE CONCENTRATED FLIGHT PLAN OF LUNAR ORBIT RENDEZVOUS: PROJECT APOLLO
Ronald W. Simpson 18 Mar. 1966 39 p refs
(NASA-TM-X-64308) Avail: CFSTI CSCL 17G

The study is based on a parking orbit mode of rendezvous termed the concentric flight plan (CFP). It could be implemented with either a rendezvous radar (RR) or a LEM optical rendezvous system (LORS). The purpose of this simulation was to (1) determine the best braking schedule for the CFP, (2) evaluate possible backup control modes for the CFP assuming an optical tracker, and (3) compare the Delta V performance of backup control modes for the LEM using the optical tracker with that of the LEM using the rendezvous radar. It was assumed that the primary system had failed prior to the transfer injection maneuver and that the transfer injection and midcourse correction maneuvers had been made with the AGS using MSFN navigation data. The backup control modes were evaluated for the terminal phase of rendezvous. Each transfer was initiated at an approximate range of 60,000 feet and terminated at a range of the order of 100 feet with a range-rate of less than 1 fps. Author

N70-34768*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ANALYSIS OF RENDEZVOUS RADAR TRACKING REQUIREMENTS FOR ANGULAR BIAS COMPENSATION DURING MISSION D
Charles R. Price 18 Feb. 1969 9 p
(NASA-TM-X-64373; MSC-69-EG-6) Avail: CFSTI CSCL 17G

An investigation to determine the length of time of RR (rendezvous radar) tracking required to insure proper compensation for RR/IMU angular bias in the LM guidance computer was made. Results of this analysis indicate that the LM Data Book Rule GNC-25 is conservative to require 15 minutes of continuous RR tracking prior to any maneuvers based on radar state vector updates. Simulations using tracking periods of 10 minutes maximum continuous tracking have shown no appreciable fuel penalty. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-33409# Institute for Nuclear Research, Warsaw (Poland).
FLUX FINE STRUCTURE, THERMAL, AND EPITHERMAL CELL PARAMETERS AND INFINITE MULTIPLICATION FACTOR IN WWR-SM LATTICE WITH INCREASED WATER-TO-FUEL RATIO
Edward T. Jozefowicz 1969 17 p refs
(INR-1119) Avail: AEC Depository Libraries

The thermal microdistributions, thermal utilization factor, epithermal cell parameters, and I.C.R. were measured in a water moderated lattice with 36% enriched UO_2 + Al fuel of multitube type WWR-SM with increased water content. The lattice contained a great number of the additional water channels regularly positioned. The comparisons with THERMOS Code calculations were performed. Author (NSA)

N70-33418# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
RADIAL POWER DISTRIBUTIONS WITHIN THE PINS OF LIGHT WATER MODERATED UO_2/PuO_2 FUELLED LATTICES
M. De Coster and F. Pistella 31 Oct. 1969 15 p refs
(RT/FI(69)50) Avail: CFSTI

Radial power distributions were calculated by transport theory within the pins of a light water moderated lattice, UO_2 fuelled and enriched to 4% of U-235 as well as of a similar lattice containing 3% of U-235 and 1% of Pu-239. The results agree very well with the experimental values measured by counting the tracks produced by fission products in insulating materials. Author

N70-33431# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
BURN-UP STUDIES OF HIFAR MARK 4 HOLLOW FUEL ELEMENTS
D. Culley [1969] 22 p refs
(AEC/TM-509) Avail: AEC Depository Libraries

Multigroup neutron transport calculations in four and 30 groups have been performed on a Mark 4 fuel element cell for the reactor HIFAR using the code WDSN. Details of the energy spectrum and fine flux structure within the element have been obtained. Variation of fine flux factors with burn-up is small enough to permit adoption of constant values for practical fuel management. A library of nuclear data, obtained from the code GYMEA, has been set up for further calculations. Author (NSA)

N70-33432# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
CALCULATION OF FLUX IN SODIUM RESERVOIR [CALCUL DU FLUX DANS UNE CUVE DE SODIUM]
Shlomo Katz, Jean-Claude Nimal and Therese Vergnaud Feb. 1970 39 p refs In FRENCH
(CEA-N-1253) Avail: AEC Depository Libraries

Calculations are made of the different responses given by detectors (S, Rh, Mn/Cd) in the model of the lower shielding of Phenix placed in the reactor Harmonie, using the code Tripoli. The calculation methods make use of sources placed at the entrance of the model. The case considered is a simple one but is typical of the majority of the possibilities offered by the three-dimensional multikinetic Monte-Carlo code Tripoli. Experimental results and calculations for spherical geometry using the code Niobe are also available. Author (NSA)

N70-33434# Institute of Nuclear Research, Warsaw (Poland).
SOME PROBLEMS OF THERMAL PROCESSES: DYNAMIC MODEL AND DIGITAL CONTROL OF NUCLEAR REACTORS [NIEKTORE PROBLEMY MODELU DYNAMIKI PROCESOW CIEPINYCH I STEROWANIA CYFROWEGO JADROWYCH REAKTOROW ENERGETYCZNYCH]
W. Ciechanowicz 1969 207 p refs In POLISH; ENGLISH summary
(INR-1121) Avail: AEC Depository Libraries

The control system synthesis involves the determination of the controller structure when the information about the process is given and the control criterion is chosen. The dynamic model of the process has to be known. This model is determined on the basis of analogy between the process and model itself. However, because of the complexity of nuclear power plant processes, a number of second importance properties of the process are neglected and only those basic factors which influence the activity of a given phenomenon and are important from the control point of view are considered. This must be done not only to resolve the basic requirements with the computational possibility but also to ensure the relationships are simple enough for analysis and simultaneously to ensure the required accuracy of the solution. There are a number of difficulties in applying the approaches of control theory to the complex systems. Author (NSA)

N70-33443# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ORPHEE 6 PROGRAM: ATTENUATION OF FAST NEUTRONS IN A LAMELLAR STRUCTURE OF WATER AND DENSE MATERIAL [PROGRAMME ORPHEE 6: ATTENUATION DES NEUTRONS RAPIDES DANS UN LAMELLAGE EAU-MATERIAU DENSE]
Michel Simon Jan. 1970 26 p ref In FRENCH
(CEA-N-1244) Avail: AEC Depository Libraries

The Orphee 6 program calculates the fact neutron flux in the side shielding of a light water reactor. The attenuation in water is treated, using the formalism of a nucleus in water, which is different from the straight-line attenuation used for heavy materials. The code also makes it possible to take the positions of the control rods into account. Orphee 6 is written in Fortran 4 language for IBM 360. Author (NSA)

N70-33446# Institute of Nuclear Research, Warsaw (Poland).
SOME BASIC STATIC PARAMETERS FOR WWR-SM LATTICE
E. T. Yuzefovich 1969 26 p refs In RUSSIAN; ENGLISH summary
(INR-P-1150) Avail: AEC Depository Libraries

The methods and results of measurements and calculations of the static parameters in the cores with multitube enriched fuel for WWR-SM type water moderated reactors are described. They include the thermal flux microdistributions, epithermal cell parameters, initial conversion ratio, and critical buckling. An attempt at estimating the neutron age using simple calculations and taking advantage of numerous published experimental and calculational data on neutron age in Al - H2O mixtures is presented. The interpretation of the results in the frames of infinite multiplication factor and two-group equation is given. Author (NSA)

N70-33450# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CELLS ASSOCIATED WITH NUCLEAR REACTORS. PHILOSOPHY AND EVOLUTION OF THEIR CONCEPTION [LES CELLULES ASSOCIEES AUX REACTEURS NUCLEAIRES. PHILOSOPHIE ET EVOLUTION DE LEUR CONCEPTION]
Claude Boulinier, Jean Meunier, and Jean Puychevrier [1969] 11 p refs In FRENCH Presented at the Intern. Symp. on Radiation Safety Probls. in the Design and Operation of "Hot" Facilities, Saclay, France, 13-17 Oct. 1969
(CEA-CONF- 1419; SM-125/19; Conf-691006-6) Avail: AEC Depository Libraries

Reactors can be classified into three large categories: research reactors, prototype power reactors constructed on a semi-industrial scale, and industrial power reactors. Each of these three types of reactors places corresponding problems on the type of hot cell associated with them. On the basis of concrete examples, the types of hot cells needed, the inferences which can be drawn from experiences with them, and the methods and means which seem most likely to give satisfactory and economic results are described. The hot cell associated with the research reactors EL-3 and OSIRIS and the hot cells associated with the prototype power reactors G2 - G3 and the Phenix reactor are discussed from these viewpoints. The industrial reactors require hot cells with characteristics very similar to the semi-industrial reactors and therefore no specific examples are given. Suggestions are made for the simplification and standardization of hot cells. NSA

N70-33464# European Atomic Energy Community, Brussels (Belgium). Reactor Physics Dept.
PROCEEDINGS OF THE CONFERENCE ON ANALYSIS OF FEW ROD EXPERIMENTS IN REACTOR PHYSICS
S. Tassan, ed. Mar. 1970 123 p refs Conf. held at Ispra, Italy, 12-14 May 1969
(EUR-4470-e) Avail: CFSTI

An overview is presented of experiments in which the nuclear properties of a reactor lattice are inferred from measurements made using only a very limited portion of it. In these experiments the properties of the test fuel element are compared with the known properties of an element having the same geometrical, chemical, and physical characteristics, except for a small change in the parameter whose reactivity effect is investigated. The theoretical methods of analysis utilized in the experiments ranges from those based on perturbation and correlation type models to very sophisticated ones. The material presented serves to review the status of development of research on thermal as well as fast reactor systems and provides: (1) significant features of the experimental techniques; (2) theoretical models used for the interpretation of the experiments; (3) results obtained under similar conditions in different laboratories; and (4) indications of trends for future developments. D.L.G.

N70-33467# United Kingdom Atomic Energy Authority, Culcheth (England). Reactor Group.
DEVELOPMENT AND PERFORMANCE OF ZIRCALOY-2 PRESSURE TUBES
B. Watkins Mar. 1970 22 p refs Presented at Symp. on the Performance of Nucl. Power Reactor Components, Prague, Nov. 1969; Sponsored by the IAEA
(TRG-Report-1966; CONF-691115-5) Avail: AEC Depository Libraries

The prototype SGHWR incorporates Zr-2 pressure tubes 5.14 in. diam., 0.2 in. thick and 15 ft. long to a straightness tolerance of 1/3000. The development work and the assessment of the mechanical and corrosion behavior of the pressure tubes are described. The pressure tubes absorb hydrogen from the corrosion reaction and this leads to reduced ductility. This embrittlement is assessed in terms of critical crack length and this is related to the operational conditions. It is shown that under the most onerous service condition the through-thickness defect, where instability occurs, is of the order of 4 in. Leakage rather than catastrophic failure can be expected to occur at a through-thickness defect of about 1/2 in. Irradiation enhances the creep rate of Zircaloy-2 and this has necessitated extensive in and out of reactor testing. Author (NSA)

N70-33477# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
FINAL ANALYSIS OF INTEGRAL AND PUNCTUAL RESULTS OF SOME MULTIGROUP STATIONARY DIFFUSION CODES [ANALISI DEI RISULTATI INTEGRALI E PUNTUALI DI ALCUNI CODICI DI DIFFUSIONE STAZIONARIA A MOLTI GRUPPI]

A. Daneri and A. Melandri 14 Apr. 1969 41 p refs In ITALIAN; ENGLISH summary
(RT/FIMA(69)3; PRV-r(68)29) Avail: CFSTI

The results of some bidimensional diffusion nuclear codes are compared. In particular, the differences between integral and punctual quantities are taken into account. The differences are explained on the basis of the mathematical methods adopted in the solution of elliptic equations in diffusion theory. Author

N70-33481# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.
THE FAST SHUTTLE RABBIT IRRADIATION FACILITY. PART 1: DESCRIPTION AND OPERATION
Miguel Wiernik Oct. 1969 15 p refs
(IA-1200) Avail: Depository Libraries

The Fast Shuttle Rabbit Facility used at Soreq for work with very short-lived nuclides is described. The pneumatic system, the automatic control and the counting equipment are described. Operating instructions and examples of different types of measurements are given. Several possible improvements are discussed. Author (NSA)

N70-33482# Bhabha Atomic Research Centre, Bombay (India).
AUTOMATIC DATA LOGGING SYSTEM FOR METEOROLOGICAL STUDIES IN REACTOR ENVIRONMENTS
C.W. Joshi, N. A. Ingle, and N. B. Jathar 1969 38 p refs
(BARC-444) Avail: AEC Depository Libraries

A 400 ft high tower, located about half a mile from the Jaraapur Atomic Power Project, is erected on which the sensors for wind speed, wind direction, temperature, etc. are located at different heights to evaluate the dispersal of effluent gases from the reactor stacks. The design and operation of an automatic data logging system for these sensors are described. The system is a wired program digital computer designed to record the data from a maximum of 248 sensors. NSA

N70-33488# Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Centro di Calcolo.
STATIONARY NEUTRON TRANSPORT IN PLANE HETEROGENEOUS ASSEMBLIES
T. Trombetti 14 Oct. 1969 24 p refs
(RT/FI(69)46) Avail: CFSTI

New methods for the solution of the neutron transport equation have been proposed and utilized, but multigroup energy dependence, anisotropic scattering and heterogeneity effects have been accounted for only separately. These effects are incorporated together into a more general formulation to increase the practical value of the methods for reactor calculations. Author

N70-33492# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
A CONTRIBUTION TO THE STUDY OF COLUMNAR GRAINS AND CENTRAL VOID IN URANIUM OXIDE FUEL RODS
G. Cosoli and G. J. Segre 1969 24 p refs
(RT/MET(69)3) Avail: CFSTI

In order to foresee the radial columnar grains and central void extension, in steady state conditions, as a function of the fuel and irradiation features, some irradiation (CNEN) experimental data are compared with the results of calculations. Author

N70-33498# Institut za Nuklearne Nauke (Boris Kidric), Belgrade (Yugoslavia).
TWENTY YEARS OF CHEMISTRY ASSOCIATED WITH THE NEEDS AND UTILIZATION OF NUCLEAR REACTORS AT THE BORIS KIDRIC INSTITUTE OF NUCLEAR SCIENCES, VINCA, YUGOSLAVIA [DVADESET GODINA HEMIJE VEZANE ZA POTREBE I KORISCENJE NUKLEARNIH REAKTORA U INSTITUTU ZA ZA NUKLEARNE NAUKE "BORIS KIDRIC" U VINCI]
1969 61 p refs In SLOVENIAN; ENGLISH summary
(IBK-832) Avail: AEC Depository Libraries

Topics covered include: radiochemistry, hot atom chemistry, production of radioisotopes, fuel reprocessing, chemistry of transuranium elements, treatment of radioactive liquid wastes, purification of cooling water for nuclear reactors using ion exchangers, research in deuterium enrichment, and chemical dosimetry of the RA reactor at Vinca. NSA

N70-33509# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
FLOW AND TEMPERATURE DISTRIBUTION INCLUDING COOLANT MIXING IN SODIUM COOLED FUEL ELEMENTS WITH ECCENTRIC GEOMETRY
F. Hofmann Feb. 1970 20 p refs Presented at Symp. on Progr. in Sodium Cooled Fast Reactor Eng., Monaco, 23-27 Mar. 1970 Supported in part by EURATOM
(KFK-1156; EURFNR-750; SM-130/40; CONF-700307-1) Avail: AEC Depository Libraries

A theoretical analysis of the temperature and velocity distribution in symmetrical and asymmetrical triangular rod clusters is presented. The analysis is applied to Na coolant with fully developed turbulent flow. Coolant mixing is taken into account by correlations for the eddy diffusivities of momentum and energy. The thermal heat flux at the outer boundary of the fuel pin is variable in circumferential and axial direction. 7 references. Author (NSA)

N70-33513# United Kingdom Atomic Energy Authority, Harwell (England). Applied Chemistry Div.
THE EFFECT OF BURNUP ON THE O/M RATIO OF IRRADIATED (U, Pu) O2 AND PuO2
J. H. Davies, F. T. Ewart, and R. G. Taylor Dec. 1969 14 p refs
(AERE-R-6264) Avail: AEC Depository Libraries; HMSO 4s; BIS $0.80

Pu-bearing oxide fuels are predicted to become increasingly oxidizing with burnup because of a lack of balance between O2 liberated by fission and the fission products. The oxygen excess in initially stoichiometric (U,Pu)O2 and PuO2 was measured as a function of burnup using a CO/CO2 gas equilibration method. There was a clear trend of increasing O/M with burnup, in fair agreement with predictions, but scatter in the data precluded a detailed test of the assumptions on which the predictions were based. The distribution of the O2 excess in an operating fuel element is discussed. Author (NSA)

N70-33529# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Reaktorphysik.
SNEAK-4: A SERIES OF PHYSICS EXPERIMENTS FOR KNK-2
P. Engelmann, comp. Oct. 1969 62 p refs
(KFK-1022; EUR-4303-e; EURFNR-746) Avail: AEC Depository Libraries

Neutron physics experiments performed at SNEAK for the investigation of some nuclear properties of the KNK-II reactor are described. The results of the measurements on SNEAK assemblies 4A and 4B are reported and compared with calculations. The experimental results of critical mass and reactivities, control rod worths, Doppler coefficient, and power distribution were used to draw conclusions for the KNK-II design. Author (NSA)

N70-33532# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
PARTLY INTEGRATED COOLING SYSTEM FOR LIQUID METAL COOLED REACTORS
R. A. Mueller Mar. 1970 14 p refs Presented at Symp. on Progr. in Sodium Cooled Fast Reactor Eng., Monaco, 23-27 Mar. 1970 Supported in part by EURATOM
(KFK-1156; EURFNR-751; SM-130/42; CONF-700307-2) Avail: AEC Depository Libraries

A partly integrated cooling system for liquid metal cooled reactors is described. The proposed system combines to a remarkable extent the advantages of the pool and loop systems generally discussed. In the new design only the reactor core and eventually an emergency cooling system is located in the reactor pool. The components of the primary circuit are installed in one or several stationary component pools which are connected with the reactor pool via straight coaxial conduits. To accommodate thermal expansion effects bellows and sliding sleeve-joints were used. However, these parts are arranged in such a way that they might be easily replaced and a possible leak will not result in a coolant leakage. Some design variants of the new partly integrated cooling system are discussed and a possible layout for a 1600 MW(e) plant is given. Author (NSA)

N70-33533# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
A METHOD OF ESTIMATING FUEL BURN-UP AND HIGHER ISOTOPE PRODUCTION IN THE REACTOR HIFAR
D. B. Mc Culloch and G. D. Trimble Jul. 1969 17 p refs
(AAEC/TM-508) Avail: AEC Depository Libraries

Simple equations have been set up to calculate fuel burn-up and higher isotope production for the HIFAR reactor, with adequate accuracy for operational management and fuel accounting purposes. Recommended nuclear data are given for use in these equations. A program HIBURN, has been written to carry out the calculations routinely on an IBM 360/50 computer. Author (NSA)

N70-33536# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Seibersdorf (Austria). Inst. fuer Chemie.
NUCLEAR FUEL PARTICLE PRODUCTION FROM URANIUM PEROXIDE SOL [KERNBRENNSTOFFPARTIKELN, HERGESTELLT AUS EINEM URANPEROXYD-SOL]
K. Knotik, H. Bildstein, and J. Bohnenstingl Jan. 1970 14 p refs Submitted for publication
(SGAE-CH-63/1970) Avail: CFSTI

Colloidal solubility of uranium peroxide dihydrate in strong organic bases is utilized to produce porous uranium oxide nuclear fuel particles. Production steps are: (1) preparation of the uranium peroxide sol from the uranium peroxide dihydrate; (2) gelation of the dispersed sol droplets in an organic medium by addition of gelation agent; (3) dehydration and heating of gel particles; (4) reductive annealing of particles to stochiometric uranium oxide spheres; and (5) sintern of uranium oxide particles. Transl. by G.G.

N70-33539# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
MICROSCOPIC EXAMINATION OF SINTERED UO2 [ESAME MICROSCOPICO DI UO2 SINTERIZZATA]
M. V. De Matteis and C. Fizzotti 5 Dec. 1969 25 p In ITALIAN; ENGLISH summary
(RT/MET(70)1) Avail: CFSTI

The results obtained during the examination of UO2 pellets at the optical and electron microscope are described. Anomalous structures which were observed and the reason of their formation are shown and discussed. Author

N70-33578# Power Reactor and Nuclear Fuel Development Corp., Tokai (Japan).
TEST MANUFACTURING OF FUEL ASSEMBLIES FOR EXPERIMENTAL FAST BREEDER REACTOR (2) (FCRE-2)
Mar. 1969 259 p refs Transl. into ENGLISH of Japan. Rept. PNC-N-841-69-3138
(JAPFNR-2) Avail: AEC Depository Libraries

Studies and evaluations on fuel pin subassemblies for the Japan Experimental Fast Breeder Reactor are described. Grid design that has the most important function in the fuel subassembly is studied and assessed for its three types. A detail design of a small test fuel subassembly for the irradiation in the Rapsodie fast reactor is being performed based upon the experiences obtained from these studies. A series of design, fabrication, and assessment studies is described for a modified A type grid assembly. All the inspection and fabrication procedures except the preparation of natural UO2 core material as the stand-in of mixed oxide were applied similarly to the future fabrication of plutonium bearing fuel. Author (NSA)

N70-33590 International Atomic Energy Agency, Vienna (Austria).
NEUTRON FLUENCE MEASUREMENTS
1970 193 p refs
(STI/DOC/10/107; TR-107) Copyright. Avail: Issuing Activity

A general discussion of the neutron energy spectrum, consisting of the thermal region, the fast or fission region, and the intermediate or slowing-down region, is presented. Supporting examples of calculated or measured neutron spectra in actual reactors are shown and a general review of the mathematical relationships coupling the three components of the spectra is presented. The methods associated with the measurement of thermal neutron fluence and the effective temperature of the thermal neutrons are presented. Detailed mathematical treatment of intermediate energy neutrons is considered due to the complex nature of the scattering cross sections in this region. Particular attention is given to the class of threshold detectors normally used for fluence measurements in the fast neutron region. Author

N70-33617# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
PREVENTION AND FIGHTING OF FIRES IN VERY-HIGH-ACTIVITY CELLS [PREVENTION ET LUTTE CONTRE LES INCENDIES DANS LES CELLULES DE TRES HAUTE ACTIVITE]
E. Roussel, B. Mansard, and G. Mangeot [1969] 23 p refs In FRENCH Presented at the Intern. Symp. on Radiation Safety Prob. in the Design and Operation of "Hot" Facilities, Saclay, France, 13-17 Oct. 1969
(CEA-CONF-1428; SM-125/20; Conf-691008-13) Avail: AEC Depository Libraries

The origin of fires in very high activity cells can be very varied and some of these are listed as examples. In the design of the cells, prevention of fires is first considered in the selection of construction materials, and then in the installation of fire detectors and fire fighting equipment. The detection methods used in the cells themselves and below the cell filters are outlined. The fire fighting methods consist of extinction products used in the cells, particular arrangements of the cells and extraction circuits, insulation devices mounted on the extraction circuits, use of special containers, and periodic retraining of the laboratory personnel. Each of these is described. The procedure followed after the detection of a fire at various locations in the cell is given. A periodic testing of the installations is made to ensure their reliability. The emphasis in fire fighting is its containment within the cell so that no contamination outside of the hot cell occurs. NSA

N70-33729# Academy of Sciences (USSR), Moscow. Institute of Atomic Energy.
DIRAC MONOPOLE
L. M. Barkov, V. P. Martemyanov, V. V. Ogurtsov, V. G. Tarasenkov, and S. Kh. Khakimov 1969 32 p refs In RUSSIAN
(IAE-1856) Avail: Depository Libraries

The basic properties of the Dirac monopole and experiments seeking monopoles on high energy accelerators are discussed.
Author (NSA)

N70-33761# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
FEW-GROUP CONDENSATION CALCULATIONS FOR LATTICE CELLS
G. Doherty Mar. 1970 15 p refs
(AAEC/TM-532) Avail: CFSTI

A procedure for condensing to few groups prior to the main transport calculation is described. The method is to perform a few region, many group, collision probability calculation to obtain condensing spectra appropriate to the different materials in the cell. Sample calculations for some natural uranium cells are reported.
Author

N70-33813# Academy of Sciences (USSR), Moscow). Institute of Physics.
STUDIES OF STELLARATOR TOR-2 MAGNETIC FIELD STRUCTURE [ISSLEDOVANIE STROKTURY MAGNITNOGO POLYA STELLARATORA TOR-2]
M. A. Ivanovskii and S. N. Popov 1969 16 p refs In RUSSIAN
(NP-18162) Avail: AEC Depository Libraries

The electron beam method was used in order to follow the force lines over a number of revolutions. The toroidal device is a stellarator with variable geometry of the magnetic field. The spiral two-turn field is created by a system of elliptical and circular coils. Since the existence of closed magnetic surfaces has been demonstrated, the use of an annular electrostatic probe was omitted, and data taking was limited to 10 to 20 readings of consecutive beams turns in order to determine the average angle of twist and surface shape. A point electron source is placed at a distance of 22/84 of the torus circumference from a slit tube where the detecting system is located. The detecting probe can be moved horizontally or vertically. The time of a single revolution of the electrons was about one microsecond. The radial dimension of the electron beam was less than 1 mm after one-half of a turn.
NSA

N70-33831 Hahn-Neitner-Institut fur Kernforschung, Berlin (West Germany).
REPORT OF THE REACTOR DIVISION [BERICHT DER ABTEILUNG REAKTOR]
In its Ann. Rept. 1969 May 1970 13 p refs In GERMAN
(See N70-33824 18-24)
(SRP-8) Copyright. Avail: Issuing Activity

Neutron scattering cross sections of several hydrogenous liquids were obtained and measurements on neutron small angle scattering on metal powders continued. A cascade impactor filter was used to measure the effects of particle velocity, size, and surface properties on the effective absorption by inertia in a reactor safety filter system.
Transl. by G.G.

N70-33832 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
REPORT OF THE RADIATION PHYSICS DIVISION [BERICHT DER ABTEILUNG STRAHLENPHYSIK]
In its Ann. Rept. 1969 May 1970 28 p refs In GERMAN
(See N70-33821 18-24)
(BSP-14) Copyright. Avail: Issuing Activity

Scientific studies are reported in radiation dosimetry, radiation shielding, and toxic aerosol inhalation. A spectrometer was developed and used to determine low energy electrons in the reaction of ionizing radiation with gases; also studied was thermoluminescence and thermal stimulated electron emission from irradiated solids as well as the calorimetric dosimetry of mixed radiation fields. A scattering laser spectrometer measured automatically aerosol particle size distributions in the inhalation system of a human phantom. A contamination study was performed to determine fission product activity in river waters after extreme reactor accidents and nuclear explosions.
Transl. by G.G.

N70-33904# Chalmers Univ. of Technology, Goteberg (Sweden).
MEASUREMENT OF THE NEUTRONIC INTERACTION BETWEEN TWO CYLINDRICAL MODERATORS
Gudmar Grosshoeg Nov. 1969 29 p refs
(CTH-RF-18) Avail: AEC Depository Libraries

The stationary interaction parameter between the plane surfaces of two identical, cylindrical, polyethylene discs were measured with the pulsed neutron method. It was shown possible to overcome the delay effect caused by the flight of the neutrons in the gap between the moderators by means of the insertion of absorbers. In the measurements, the ratio of separation distance to diameter was varied between 0.06 and 0.77 and the corresponding interaction parameter went from 0.93 to 0.24. Using two different thicknesses of the discs, two series of measurements were performed, one covering decay constants between 10,000 and 17,000 per flight path length and the other range 17,000 to 40,000 per flight path length. Although full equilibrium of the neutron distribution was not reached in all cases in the last series, the resulting values of the two series show a general agreement.
Author (NSA)

N70-33935# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
MODEL FOR SELF-QUENCHING OF BOILING IN THE OPERATION OF WATER REACTORS DURING POWER PRODUCTION [MODELLO di AUTOSPEGNIMENTO PER EBOLLIZIONE NELLE ESCURSIONI DI REATTORI AD ACQUA DURANTE IL FUNZIONAMENTO A POTENZA]
M. Michelini 26 Nov. 1969 81 p refs In ITALIAN; ENGLISH summary
(RT/FI(70)2) Avail: CFSTI

In a preceding paper a model of the boiling self-control in the excursions of zero power pool water reactors was presented. In this work, in order to evaluate the escursions of power reactors, the above model in integrated with regard to the following points: (1) fuel temperature distribution at the boiling first appearance, (2) temperature of boiling first appearance, (3) void volume, (4) bubble lifetime, (5) void carrying away and (6) forced convection cooling.
Author

N70-33972*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
THERMIONIC SPACECRAFT DESIGN STUDY Final Report
30 Jun. 1970 194 p refs Prepared for JPL
(Contract NAS7-100; JPL-952381)
(NASA-CR-109884; GESP-7045) Avail: CFSTI CSCL 18E

The results of a design study of nuclear-electric propelled unmanned spacecraft are presented. The electric power source is in-core thermionic reactors based on either the internally (flashlight) or externally fueled diode concept. The study guidelines and approach are defined. The characteristics of the candidate launch vehicles, thrust subsystem, and the payload and communications subsystem are presented. The definition of two spacecraft/powerplant configurations are presented which deliver 240 kWe net to the thruster array. The definition, presented for both the flashlight and externally fueled reactors includes the key items of spacecraft arrangement and a detailed weight breakdown. Power conditioning,

heat rejection subsystem, shielding, and spacecraft structure are detailed. The results show about a 30 percent weight advantage for the spacecraft based on the externally fueled reactor. This is primarily due to a 120 vdc power output from the externally fueled reactor, as compared to a 15 vdc power output from the flashlight reactor. Author

N70-34006*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A DESIGN STUDY FOR A MAGNETOHYDRODYNAMIC POWER SYSTEM FOR A NUCLEAR ELECTRIC PROPELLED UNMANNED SPACECRAFT Final Report, 26 May 1969 - 25 May 1970
Jul. 1970 305 p refs Prepared for JPL
(Contract JPL-952415)
(NASA-CR-109851; GESP-7041) Avail: CFSTI CSCL 21F

This report discusses the progress made in a one-year design study of nuclear-electric propelled unmanned spacecraft using a liquid metal magnetohydrodynamic (MHD) power system. The study guidelines and approach are defined here, and the characteristics of the launch vehicle, the thruster subsystem, and the payload and communications system are presented. The MHD power conversion system is described and methods used to calculate MHD system parameters are discussed. This report includes a discussion of the arrangement and structural arguments used to select system configuration. The system startup technique is identified, and the detailed design and weight summaries are presented for systems of 100 kWe to 3 MWe power rating. Author

N70-34007*# Hittman Associates, Inc., Columbia, Md.
RADIATION FLUX MAPPING OF OPE SPACECRAFT MODELS, PHASE 1
Mar. 1970 26 p refs
(Contract NAS5-11225)
(NASA-CR-109876; HIT-439) Avail: CFSTI CSCL 18F

Spacecraft equipped with radioisotope thermoelectric generators (RTG) present a unique problem with respect to any of the on board radiation sensors. Photon and neutron emission from the radioisotopic fuel can seriously perturb the measurement of the extremely low particle flux fields in the vicinity of the spacecraft. Even when sufficient shadow shielding of primary RTG radiation is present between the RTG and the radiation sensor, scattered radiation can be a problem. The RTG and sensor booms, and the spacecraft itself, constitute potential scatter zones for the RTG radiation. Analytical techniques are developed and applied in evaluating the primary and scattered RTG radiations with respect to selected OPE spacecraft models. Author

N70-34152*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATIC TESTS OF 4-INCH OUTSIDE-DIAMETER FRANGIBLE TUBE ENERGY ABSORBERS FOR NUCLEAR AIRCRAFT
Klaus Gumto and Richard Puthoff [1970] 22 p refs
(NASA-TM-X-52847; E-5778) Avail: CFSTI CSCL 18J

Ten frangible tubes with outside diameters more than 3-1/2 inches (9 cm) were statically tested on a tensile machine. Five tubes failed to frange, while the results of the remaining five correlated with previous experiments. Problems were traced to load angle sensitivity, slow testing speed, and large tolerances of the as-received tubes. Author

N70-34153# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
CALCULATION OF THE GEOMETRY OF MAGNETIC CHANNELS FOR SYNCHROCYCLOTRONS AND CYCLOTRONS
B. Carbonel, V. I. Danilov, M. Ianovich, and E. A. Polferov 1970 69 p refs
(JINR-E9-4915) Avail: AEC Depository Libraries

A program written in FORTRAN-63 for the calculation of magnetic extracting or focusing channels for particle accelerators has been set up. The program calculates the geometrical parameters which are necessary to obtain the required field for an extracting channel, or the field and gradient for a focusing channel with a precision of 2% and 10%, respectively. The program is aimed at computing the number and parameters of correction shims which correct the perturbation field produced by the channel towards the machine center. Author (NSA)

N70-34248* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROSTATIC PROPULSION SYSTEM WITH A DIRECT NUCLEAR ELECTROGENERATOR Patent
Charles A. Low, Jr. and William R. Mickelsen, inventors (to NASA) Issued 25 May 1965 (filed 21 Jan. 1963) 8 p Cl. 60-35.5
(NASA-Case-XLE-00818; US-Patent-3,184,915;
US-Patent-Appl-SN-253006) Avail: US Patent Office CSCL 21F

The electrogenerator consists of a decaying radioisotope which emits charged particles and serves as a nuclear energy source. The emitted particles impinge on, into, or through a collector, which creates an electric potential difference between the emitting surface and the collector. The kinetic energy of the charged particles is directly converted into electrical energy as the emitted particles do work against an electric field created between the emitting surface and the collector. The potential difference created in the electrogenerator cell is used to accelerate charged propellant particles or molecules in an electrostatic thruster. R.D.

N70-34304*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF A SNAP-8 TURBINE-ALTERNATOR
Fred Boecker Jul. 1970 32 p refs
(NASA-TM-X-252865) Avail: CFSTI CSCL 18N

The steady-state performance of a SNAP-8 turbine-alternator was evaluated as part of an investigation of system startup characteristics. The turbine-alternator accumulated 157 hours and was subjected to 135 startups and shutdowns. During the test series, alternator power was varied from 49 to 66 kilowatts at system design mercury flow rate of 12,000 lbm/hr. The minimum alternator power obtained at system self-sustaining mercury flow of 6600 lbm/hr was 21 kilowatts. The large number of startups and shutdowns of the turbine-alternator did not result in degradation in performance or operating characteristics. Author

N70-34356# Battelle-Northwest, Richland, Wash. Solid State Physics Group.
REACTOR ENGINEERING DEVELOPMENT. REACTOR ENVIRONMENTAL EFFECTS ON SIGNAL CABLES Quarterly Report, Oct. - Dec. 1969
J. L. Stringer Mar. 1970 27 p refs
(Contract AT(45-1)-1830)
(BNWL-1325) Avail: CFSTI

The development of a noise measurement system and furnace at a cobalt-60 facility for measuring radioinduced noise in cables is described. Radiation induced current, radiation and temperature dependent electrical noise, and radiation induced insulator conductivity are discussed. Author (NSA)

N70-34407# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CONCEPTUAL SYSTEM DESIGN DESCRIPTION FOR THE REACTOR CORE SYSTEM NO. 31, FAST FLUX TEST FACILITY

G. R. Waymire 27 Aug. 1969 155 p refs
(Contract AT(45-1)-1830)
(BNWL-500-Vol-31) Avail: CFSTI

Conceptual design calculations and parameters are presented for fast test reactor core components. Core structures, control elements, control element drives, fuel elements, and instrumentation systems are described. NSA

N70-34408# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FTF MODIFIED FERMI CONTROL ROD DRIVE MECHANISM CONCEPTUAL DESIGN STUDY
J. R. Mc Bride and B. C. Fryer Jun. 1969 116 p refs
(Contract AT(45-1)-1830)
(BNWL-970) Avail: CSFTI

Conceptual design calculations and parameters are presented for fast test reactor control rod drives. The drives are based on the Fermi Fast Breeder Reactor safety rod concept. NSA

N70-34447# Douglas United Nuclear, Inc., Richland, Wash.
ON-STREAM ANALYSIS AND CONTROL OF NUCLEAR REACTOR ATMOSPHERE IN WATER-COOLED GRAPHITE MODERATED REACTORS
T. M. Clement 20 Nov. 1969 11 p Presented at the Intern. Meas. Confederation Conf., Versailles, France, 25-30 May 1970
(Contract AT(45-1)-1857)
(DUN-SA-118; Conf-700513-1) Avail: CFSTI

A description of an inert cover-gas system for a water-cooled graphite-moderated reactor is presented. The control system for the cover-gas circuit is described. The inert gas system protects the graphite from oxidation, detects water leaks, and removes moisture when leaks do occur. Circuit diagrams for the inert gas system and control system are included. NSA

N70-34448# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
THE DESIGN AND FABRICATION OF SODIUM-BONDED (U, Pu)C FUEL PINS FOR TESTING IN EBR-2
A. Biancheria, A. Boltax, B. L. Harbourne, and W. R. Jacoby Feb. 1970 63 p refs
(Contract AT(30-1)-3791)
(WARD-3791-43) Avail: CFSTI

Activities in a program to evaluate problems associated with development of swelling accommodation in PuC-UC fuel elements are reported. Other aspects investigated include fuel-clad reactions and sodium bond behavior. Information is presented in sections on pin and capsule design analysis, fuel fabrication, fuel characterization, fuel pin fabrication, and capsule fabrication and assembly. NSA

N70-34449# Florida Univ., Gainesville. Dept. of Metallurgical and Materials Engineering.
QUANTITATIVE DETERMINATION OF THE STRUCTURE-PROPERTY RELATIONSHIPS IN NUCLEAR FUEL ELEMENT MATERIALS Quarterly Progress Report, 15 Dec. 1969 - 15 Mar. 1970
F. N. Rhines, R. T. De Hoff, and L. L. Hench Apr. 1970 22 p refs
(Contract AT(38-1)-552)
(SRO-552-3) Avail: CFSTI

Measurements of the variation of gas permeability with porosity and particle size are found to strongly correlate with independent measurements of the genus (connectivity), for a given particle size, but to be proportional to the first power of the particle size. An apparatus for determining thermal conductivity was received, and initial thermal conductivity measurements made. The first creep test of a porous nickel sintering was successfully performed. The first loose stack sinterings of uranium dioxide powder were prepared by sintering in a tungsten wound furnace at 2250 C. New rationalization of the variation of tensile properties of porous copper compacts was evolved and successfully applied to experimental determinations of these properties. The application required the development of a technique in quantitative microscopy, involving the determination of extreme values of microstructural properties from measurements made on fracture surfaces. Author (NSA)

N70-34497# Bettis Atomic Power Lab., Pittsburgh, Pa.
IN-PILE AND UNIRRADIATED THERMAL CONDUCTIVITY OF A SINGLE-FIRED ThO2 + w/o UO2 (LWBR DEVELOPMENT PROGRAM)
D. C. Jacobs Feb. 1970 30 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-901) Avail: CFSTI

The in-pile and unirradiated thermal conductivites of a single-fired ThO2 + 10 wt % UO2 fuel were determined. The in-pile data were obtained at 300 = to or < T = to or < 900 C to a burnup 2.6 × 10 to the 17th power fissions/cu cm. The test results showed that there is no apparent difference between the in-pile and unirradiated thermal conductivities. The conductivities of the single-fired material were compared with those of a double-fired ThO2 = 10 w/o UO2 of comparable density. The double-fired material had relatively small grains and small, uniformly distributed pores as compared with the large grains and necklace porosity of the single-fired fuel. The comparison of these data showed that the conductivities of the two fuels are significantly different; the curve for single-fired fuel achieves higher conductivity values than the double-fired fuel at temperatures greater than 1000 C. This difference is attributed to the differences in structure between the two materials. Author (NSA)

N70-34501* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUCLEAR REACTOR CONTROL ROD ASSEMBLY WITH IMPROVED DRIVING MECHANISM Patent
John W. Macomber, inventor (to NASA) Issued 3 Aug. 1965 (filed 1 May 1963) 16 p Cl. 176-35
(NASA-Case-XLE-00298; US-Patent-3,198,709; US-Patent-Appl-SN-277402) Avail: US Patent Office CSCL 18E

An improved reactor control rod assembly is described with replaceable sections, and an improved rod driving mechanism located below the assembly. Elongated control rod assemblies are provided which form both regulator rods and shim rods extending vertically through the reactor core, and arranged in a position adjacent to the fuel elements of the core. F.O.S.

N70-34506# Oak Ridge National Lab., Tenn.
MATERIAL FORM FOR MAXIMUM SAFETY IN THE SHIPPING OF ALPHA-EMITTING MATERIALS
R. E. Brooksband and W. H. Carr Apr. 1970 13 p refs
(Contract W-7405-eng-26)
(ORNL-4554) Avail: CFSTI

Plutonium and other alpha-emitting materials are commonly shipped from a chemical processing plant in the form of nitrate solutions. Whereas this is currently an acceptable practice, the anticipated shipping requirements of the LMFBR program make reexamination of the safety aspects of the shipping form of such materials advisable. Results of a study of the safety considerations involved in choosing a form for shipping alpha-emitting materials are presented. A summarization of an economic comparison of liquid and solid forms for rail and truck shipment is included. Although the shipment of liquids has certain inherent advantages, the shipment of solids is significantly less expensive and is also much safer for any given container. Data are presented to show that safety considerations to favor the shipment of alpha-emitting

materials in the form of a solid; this solid form will probably be an oxide; and the safest physical form is a microsphere.
Author (NSA)

N70-34520# Atomics International, Canoga Park, Calif.
RESEARCH ON CARBIDE FUELS: AN IRRADIATION TEST OF SWELLING CONTROL BY FINE PARTICLE DISPERSIONS
G. Ervin, Jr. 15 Mar. 1970 61 p refs
(Contract AT(04-3)-701)
(AI-AEC-12928) Avail: CFSTI

An irradiation experiment on the swelling of uranium carbide fuel was performed to evaluate the concept of using a dispersion of fine particles in the fuel structure as a means of trapping fission gases as very small bubbles and thereby reduce swelling. The dispersions were made by additions of 1.5 to 3.0 wt % tungsten to the uranium monocarbide, and the specimens were irradiated to a maximum of approximately 2 at. % burnup. Density changes were used as the measure of swelling, comparing tungsten-doped specimens with undoped uranium monocarbide control specimens. There was a great deal of scatter in the results. Tungsten did cause a reduction in swelling for those groups in which a uniform dispersion was present. For some other groups having excess uranium and tungsten or a segregated structure (due to preparation by arc casting), tungsten caused an increase in swelling. It was concluded that the results provide tentative confirmation that fine particles are of value in reducing fission gas swelling of carbide fuels.
Author (NSA)

N70-34521# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
PREPARATION AND CRYSTAL STRUCTURE OF NAUO3 AND NA11U5O16
S. F. Bartram and R. E. Fryxell Apr. 1970 10 p refs
(Contract AT(40-1)-2847)
(GEMP-733) Avail: CFSTI

Samples of NaUO3 and Na11U5O16 were prepared by reacting mixtures of Na2CO3 with UO2 at various mole ratios in an argon atmosphere at temperatures ranging from 700 C for 160 hours to 1000 C for 16 hours. The crystal structure of NaUO3 was verified by X-ray intensity measurements obtained from a well-annealed single phase sample. The results showed that the proposed structure must be essentially correct although the X-ray intensities were not very sensitive to the Na and O positional parameters. A second complex oxide was observed in reaction products having a Na: U mole ratio greater than 1.0. Calculated and observed results identified the oxide as Na11U5O16. X-ray data are tabulated.
NSA

N70-34522# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
PHYSICAL-CHEMICAL STUDIES OF CLAD UO2 UNDER REACTOR ACCIDENT CONDITIONS
E. F. Juenke and J. F. White Apr. 1970 66 p refs
(Contract AT(40-1)-2847)
(GEMP-731) Avail: CFSTI

The behavior of Zircaloy-clad UO2 and 304L stainless steel clad fuel elements in steam and in steam-air mixtures from 1000 C to the melting point of UO2 was investigated. Results of dynamic (i.e., transient temperature) testing to determine combined effects of internal pressure, heating rate, and atmosphere on the deformation and failure behavior of Zircaloy cladding materials are reported. Similar studies were conducted on 304L stainless steel. Tensile strength and ductility measurements were made on oxidized Zircaloy-4. Modifications and check-out of apparatus for testing irradiated tubes under dynamic conditions were accomplished to accommodate tubes of smaller dimensions than those previously tested and to provide fixturing for testing in a steam atmosphere. Studies on the phase relationships and melting behavior in the UO2 – Zr pseudobinary system were continued. The effects of dynamic heating on the annealing of irradiation induced defects in Zircaloy-2 cladding from Dresden I were evaluated by electron microscope examination.
Author (NSA)

N70-34562# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
TESTING A NEW CONTROL ROD CONCEPT FOR REACTORS WITH PELLET FUEL ELEMENTS [UEBER VERSUCHE ZU EINEM NEUEN ABSCHALTSTABKONZEPT FUER DEN KUGELHAUFENREAKTOR]
K. H. Hammelmann, R. Hecker, M. Galka, H. Hellinger, W. Tschalaer et al Oct. 1969 108 p refs In GERMAN
(JUL-622-RG) Avail: CFSTI

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1. RESEARCH AND DEVELOPMENT AND DETERMINATION OF DATES FOR CONSTRUCTING DIFFERENT REACTOR COMPONENTS, PART 1 70 p refs (See N70-34563 18-22)

2. STATISTICAL ANALYSIS OF TESTS TO DETERMINE THE FRACTURE RATE OF FUEL ELEMENTS, PART 2 35 p refs (See N70-34564 18-22)

N70-34563# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
RESEARCH AND DEVELOPMENT AND DETERMINATION OF DATES FOR CONSTRUCTING DIFFERENT REACTOR COMPONENTS, PART 1 [VERSUCHSABWICKLUNG SOWIE BESTIMMUNG VON DATEN ZUR AUSLEGUNG VERSCHIEDENER REAKTORKOMPONENTEN, TEIL 1]
In its Testing A New Control Rod Concept for Reactors with Pellet Fuel Elem. Oct. 1969 70 p refs In GERMAN (See N70-34562 16-22)
Avail: CFSTI

Tests were conducted on a full-scale model of a high temperature thorium reactor to determine the strength of the absorber rods and pressure vessel and the required torque of the rods. The reactor is designed to have 36 rods, but only 2 were tested in the model; a single rod was tested in a 1.0 m vessel and 2 rods were tested in a 1.5 m vessel and the results were compared. The tests were conducted with graphite and steatite pellets under the same conditions, which made it possible to determine the combined effect of friction and specific gravity. Comparison of the pressure and rate of lowering or hoisting the rods and the different shapes of the rod ends is presented in tabular form.
Transl. by R.B.

N70-34564# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
STATISTICAL ANALYSIS OF TESTS TO DETERMINE THE FRACTURE RATE OF FUEL ELEMENTS, PART 2 [STATISTISCHE AUSWERTUNG DER VERSUCHE ZUR BESTIMMUNG DER BRENNELEMENTBRUCHRATE, TEIL 2]
In its Testing A New Control Rod Concept for Reactors with Pellet Fuel Elem. Oct. 1969 35 p refs In GERMAN (See N70-34562 18-22)
Avail: CFSTI

The load on the fuel element and the breaking load distribution curves were calculated. The load distribution is determined by calculating the amount and force of impact between the rod and fuel element. The strength of the rods previously determined from tests in a pellet mass, is also dependent on the amount and size of the pellet packing structure. The breaking load distribution curves are determined empirically by testing the pellets to the breaking point, and the quantity of pellets is plotted as a function of load.
Transl. by R.B.

N70-34565# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs
ORTC-3 IN-REACTOR EXPERIMENT

W. G. Baxter and R. Pugh. Washington AEC Dec. 1969 49 p
(Contract AT(40-1)-2847)
(GEMP-739) Avail: CFSTI

The chemical compatibility of W-25Re and Re thermocouple sheath materials in contact with mixed oxide fuel (80% UO_2–20% PuO_2) at 2300 C for a period of 1000 hours was investigated. A mixed oxide fuel capsule was fabricated using 316 SS tubing (1/4 in. OD). The fuel pellets were cored (0.065 in. diameter) to allow insertion of a metallic thermocouple sheath. Both W-25Re and Re were evaluated as thermocouple sheath (0.0625 in. OD × 0.007 in. wall) materials in contact with the mixed oxide fuel. A W, W-25Re thermocouple (0.009 in. diameter wires) was fabricated using high purity hafnia as an insulator (0.046 in. diameter, two-0.012 in. diameter holes) to measure centerline fuel temperatures. The fuel capsule was designed to operate at 2300 C centerline temperature. The fission heat was dissipated through the cladding into liquid sodium, through a 5 mil helium gap into circulating water. The test operated 4.5 hours at 2100 to 2275 C with estimated temperatures as high as 2500 C in the lower portions of the fuel. Author (NSA)

N70-34568# Oak Ridge National Lab., Tenn.
HEAVY ELEMENT COMPOSITION OF SPENT POWER REACTOR FUELS
M. J. Bell. May 1970 37 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2897) Avail: CFSTI

Calculations were made of the heavy element composition of spent fuels for a number of reactor and fuel types. The composition, activity, and thermal power of the transuranium elements are given at time of discharge from the reactor and as a function of cooling time for times up to 10 years after discharge. Reactor and fuel types are considered which are representative of advanced light water converter reactors and first generation fast breeder reactors. Author

N70-34572* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GASEOUS NUCLEAR ROCKET Patent
Frank E. Rom, inventor (to NASA) Issued 24 Aug. 1965 (filed 28 Aug. 1961) 7 p Cl. 176-52
(NASA-Case-XLE-00321; US-Patent-3,202,582;
US-Patent-Appl-SN-134478) Avail: US Patent Office CSCL 21F

A gaseous nuclear propulsion system is described which provides a nuclear gaseous reactor for heating the working fluid to high temperatures. The working fluid is introduced concentrically adjacent to a gaseous fissionable material in a heating chamber. This permits transfer of heat by radiation, and reduces mixing, increasing the residence time of the fissionable material. F.O.S.

N70-34583# Los Alamos Scientific Lab., N.Mex.
PU 238 SPACE ELECTRIC POWER FUEL DEVELOPMENT PROGRAM Quarterly Status Report, 1 Oct.–31 Dec. 1968
3 Feb. 1969 14 p
(Contract W-7405-eng-36)
(LA-4089) Avail: CFSTI

Results of research and development are reported on fabrication of disks of PuO_2–ZrO_2 compositions, microstructures of $Pu-238O_2$ and $Pu-238O_2$–ThO_2 materials, compatibility of TZM with these fuels, He diffusion from fuels, thermal diffusivity of $Pu-238O_2$–ZrO_2 compositions, solubility of solid solution fuels in seawater, and impact properties of fuel capsules. NSA

N70-34584# Los Alamos Scientific Lab., N.Mex.
PU 238 SPACE ELECTRIC POWER FUEL DEVELOPMENT PROGRAM Quarterly Status Report, 1 Jul.–30 Sep. 1969
8 Dec. 1969 15 p
(Contract W-7405-eng-36)
(LA-4328) Avail: CFSTI

Research results are reported on preparation of solid solution cermets, properties of actinide oxide pellets, helium migration in fuels, and design and installation of metallurgy equipment. A schedule for developing solid solution cermets is included. NSA

N70-34586# Brookhaven National Lab., Upton, N.Y.
TABULATED DOSE DISTRIBUTION DATA FOR GAMMA IRRADIATOR DESIGN
F. X. Rizzo, L. Galanter, and K. Krishnamurthy Apr. 1969 66 p
(BNL-50147) Avail: CFSTI

Data are tabulated which make available to the designer of package irradiators the dose distribution information necessary to perform quick, easy, and reasonably accurate calculations of the dose distribution characteristics of irradiators when using either cobalt-60 or cesium-137 plaque sources. The data should find its greatest use in performing dose distribution calculations necessary for plant and product feasibility studies, cost estimates for bid purposes, and for most preliminary design calculations. The data presented in the tables are the depth dose distributions in semi-infinite homogeneous media over a range of target densities from both cobalt-60 and cesium-137 source plaques of various sizes. These targets were assumed to be bounded only at the front surfaces, by the source, air gap, and the absorbers. NSA

N70-34587# Brookhaven National Lab., Upton, N.Y.
TABULATED DOSE UNIFORMITY RATIO AND MINIMUM DOSE DATA FOR GAMMA IRRADIATOR DESIGN
F. X. Rizzo, L. Galanter, and K. Krishnamurthy Apr. 1969 122 p
(BNL-50145) Avail: CFSTI

Dose uniformity ratio and minimum dose data in cobalt-60 and cesium-137 rectangular source irradiators are presented in tables. Dose distribution tabular data are in this way supplied to the irradiator designer, allowing quick approximation of the performance of most gamma irradiators which utilize rectangular sources and targets. The data should find its greatest use in performing estimates for plant and product feasibility studies, cost estimates, and for preliminary design calculations. NSA

N70-34588# Los Alamos Scientific Lab., N.Mex.
CONSTRAINED OPTIMAL PROGRAMMING PROBLEMS IN REACTOR STATICS
Roy Arthur Axford Aug. 1969 30 p refs
(Contract W-7405-eng-36)
(LA-4267) Avail: CFSTI

Optimal fuel concentration distributions, which maximize the power rating of a reactor assembly, are determined for various sets of inequality constraints. These include constraints on the upper and lower limits of the allowable fuel concentration, the upper limit of the power density, and the upper limit of the fast flux level and the level of the sum of the fast and thermal fluxes. Author (NSA)

N70-34589# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DYNAMIC DIGITAL COMPUTER SIMULATION OF THE FFTF DUMP HEAT EXCHANGER
R. N. Madsen Apr. 1970 70 p refs
(Contract AT(45-1)-1830)
(BNWL-1319) Avail: CFSTI

The complex problem of analytically modeling the FFTF extended-surface Na-to-air dump heat exchanger (DHX) for dynamic simulation is investigated in detail. The development of an extremely detailed reference model followed by the determination of an idealized yet adequate simple model is described. In connection with this study, a detailed investigation of transient fin efficiency for fins of constant thickness is reported. Author (NSA)

N70-34590# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FFTF SHIELDING PROGRAM
W. L. Bunch Apr. 1970 44 p refs
(Contract AT(45-1)-1830)
(BNWL-1333) Avail: CFSTI

The development program required to support the design of nuclear radiation shields throughout the Fast Flux Test Facility (FFTF) is described. The development plan is based on providing adequate and timely design information for the unique features of the facility. Remaining development work is indicated for penetrations and for special Na-steel shield geometries. In addition to experimental work, analytical techniques and nuclear data need to be refined and developed for use with the materials of interest in the design of liquid-metal cooled, fast-reactor shields. Author (NSA)

N70-34591# Gulf General Atomic, San Diego, Calif.
FISSION PRODUCT TRANSPORT IN HTGR SYSTEMS: SUMMARY
F. E. Vanslager, W. E. Bell, O. Sisman, and M. T. Morgan 22 Apr. 1970 28 p refs Presented at the Gas-Cooled Reactor Program Inform. Meeting, Oak Ridge, Tenn., 27-29 Apr. 1970
(Contract AT(04-3)-167)
(GA-10073; CONF-700401-1) Avail: CFSTI

A brief summary of fission product transport in a gas-cooled reactor is presented. Analytical methods applicable to reactor situations are presented along with a variety of old and new experimental data to illustrate the calculational techniques. These methods indicate that the gaseous activity in a well-designed gas-cooled reactor system can be easily held to acceptable levels and will consist almost entirely of noble gases. Some plateout activity will result from these noble gas precursors as well as from the halogen precursors which are found to have release rates essentially equal to noble gases. The other fission products, provided normal precautions are taken, will not be released from the fuel elements in sufficient quantities to significantly increase the plateout levels above that resulting from these gaseous precursors. Author (NSA)

N70-34593# Gulf General Atomic, San Diego, Calif.
PLANNED THERMAL IRRADIATION OF MANIFOLDED VENTED (U, PU) O2-FUELED ROD IN ORR CAPSULE P-9
J. R. Lindgren, R. D. Burnette, R. J. Campana, N. L. Baldwin, S. Langer et al 15 Mar. 1970 109 p refs
(Contract AT(04-3)-167)
(GA-9896) Avail: CFSTI

The purpose of the test is to study the performance and the adequacy of the manifolded fuel rod (Vented to an external plenum) and its fission-product trap under conditions that are prototypical of early cores in the Gas-Cooled Fast Breeder Reactor (GCFR) demonstration plant. Test conditions include operation of the fuel rod (GA-20) for a long irradiation period to achieve a burnup approximately 50,000 MWd/Te at a linear heat-generation rate of 16 kW/ft and a maximum cladding outer surface temperature of 700 C and operation of the fission-product trap with its outer surface at approximately 300 C. The (U,Pu)O2 fuel is of the solgel blended type to provide homogeneity of the Pu distribution. Fission products effusing from the trap and fuel rod during steady-state operation and during breathing will be monitored to determine the performance of the fuel and the fission-product trap. NSA

N70-34594# Oak Ridge National Lab., Tenn.
A PROCEDURE FOR PREDICTING THE EFFECTS OF LOSS-OF-COOLANT ACCIDENTS IN THE ORNL TOWER SHIELDING REACTOR 2
G. J. Kidd, Jr. May 1970 25 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2853) Avail: CFSTI

An analytical study has been made of the temperature distribution in the Tower Shielding Reactor 2 at Oak Ridge National Laboratory following a complete and instantaneous loss of coolant water. The temperature structure is examined in detail for several different operating schemes. The results of this analysis are then generalized to produce a workable set of administrative procedures which will guarantee safe operation. Author (NSA)

N70-34595# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
MODIFIED FERMI CONTROL ROD LATCH FOR THE FFTF: REPORT ON THE DEVELOPMENT AND TESTING PROGRAM
J. R. Mc Bride Apr. 1970 61 p refs
(Contract AT(45-1)-1830)
(BNWL-1335) Avail: CFSTI

A development and testing program was conducted on an electromagnet and latch assembly for the Modified Fermi Control Rod Drive Mechanism Concept proposed for the Fast Flux Test Reactor (FTR). The components tested were designed to the FTR conceptual requirements. The electromagnet was successfully tested in ambient air to determine the load carrying capability (1000 lb) and release characteristics. The latch assembly was successfully tested in water for 5000 latch and scram cycles with a simulated load of 2400 lb. Author (NSA)

N70-34597# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PLUTONIUM UTILIZATION PROGRAM Quarterly Report Dec. 1969 – Feb. 1970
Apr. 1970 170 p refs
(Contract AT(45-1)-1830)
(BNWL-1358) Avail: CFSTI

Progress is reviewed for work in reactor neutronics, fuels technology, and reactor safety. The deactivation status of the Plutonium Recycle Test Reactor is also discussed. E.C.

N70-34631# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.
FAST REACTOR MIXED-CARBIDE FUEL ELEMENT DEVELOPMENT PROGRAM Quarterly Progress Report, Oct. – Dec. 1969
J. Anderson, L. Flynn, P. Fuery, C. Grando, A. Magdics et al 15 Mar. 1970 30 p
(Contract AT(30-1)-3415)
(UNC-5253; QPR-10) Avail: CFSTI

The destructive post-irradiation examination of three fuel rods containing helium-bonded, high-density (UPu)C + 10 vol % (UPu)2C3 pellets irradiated to 40,000 MWd/t at 31 kW/ft in the EBR-II has been initiated. Results indicate what may be a reaction zone in the Type 316 stainless steel clad adjacent to the fuel. The fuel exhibited a structure similar to unirradiated material and that which has been observed in previous irradiation experiments. Three fuel rods, operating at 20 kW/ft in the EBR-II, have accumulated a peak burnup of 69,000 MWd/t. The rods contain helium-bonded high-density uranium-plutonium carbide pellets. A fourth experiment containing sodium-bonded mixed-carbide pellet fuel rods was discharged from the GETR after achieving its goal burnup of 50,000 MWd/t. Author (NSA)

N70-34662# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
SNAP-23A PROJECT: ADVANCED TERRESTRIAL RADIOISOTOPE POWER SYSTEMS Quarterly Progress Report, 1 Dec. 1969 – 28 Feb. 1970
Apr. 1970 86 p refs
(Contract AT(30-1)-3800)
(WANL-3800-45; WANL-PR(SS)-37) Avail: CFSTI

Research and development on SNAP-23A are reported in sections on program management, product assurance, system design, materials and components testing, and safety analysis. NSA

N70-34689# Gulf General Atomic, San Diego, Calif.
THE 40-MW(E) PROTOTYPE HIGH-TEMPERATURE GAS-COOLED REACTOR POSTCONSTRUCTION RESEARCH AND DEVELOPMENT PROGRAM Quarterly Progress Report, Period Ending 31 Jan. 1970
27 Feb. 1970 21 p
(Contract AT(04-3)-314)
(GA-9898) Avail: CFSTI

Maintenance and core inspection activities performed during November 1969 to January 1970 are described. Fast neutron effects on core materials and fuel elements are analyzed. NSA

N70-34694# Bettis Atomic Power Lab., Pittsburgh, Pa.
CORROSION OF OXIDE NUCLEAR FUELS IN HIGH TEMPERATURE WATER (LWBR DEVELOPMENT PROGRAM)
J. M. Markowitz and J. C. Clayton Feb. 1970 56 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-909) Avail: CFSTI

The corrosion behavior of a group of nuclear fuel oxides including urania, thoria, urania-zirconia, urania-calcia-zirconia, and urania-thoria was studied in 360 C, pH 10 flowing water, both degassed and oxygenated (5 and 100 ppM). Weight gains of the specimens, which were of plate or cylindrical pellet shape, were determined periodically during the corrosion exposures, some of which were as long as 500 days; in addition, ceramographic examinations, X-ray diffraction measurements, and chemical analyses were carried out on selected specimens. The results are summarized and discussed. Author (NSA)

N70-34719# United Nuclear Corp., Elmsford, N.Y.
AN INTERPRETIVE REVIEW OF SEISMIC DESIGN METHODS
May 1970 97 p refs Prepared for Oakridge Natl. Lab.
(Contract W-7405-eng-26)
(ORNL-TM-2900) Avail: CFSTI

The procedures and analytical methods most suited to a seismic design analysis of structures, with particular reference to Class I nuclear power systems, are presented. These procedures include the prediction and simulation of the earthquake forcing function, determination of the dynamic response of the system structural model, evaluation of structural components and a failure analysis. The deterministic approach to earthquake motion simulation is used although the probabilistic approach is recommended for future study and application. A linear elastic structural model formulated by either the lumped parameter or finite element method appears to be a practical choice to model the complicated structure of a nuclear reactor and its components. The modal analysis technique is recommended for computing both stationary and non-stationary dynamic responses. Numerical procedures applicable to digital computer programs are presented, and a survey of the available applicable digital computer programs to compute both the structural model and its dynamic response is recommended. Author (NSA)

N70-34720# Atomics International, Canoga Park, Calif.
LARGE RADIOISOTOPE HEAT SOURCE CAPSULE PROGRAM. TOPICAL REPORT NO. 8: CAPSULE IMPACT TESTING
J. M. Harris 23 Jan. 1970 62 p refs
(Contract AT(29-2)-2338)
(AI-AEC-12922) Avail: CFSTI

The Large Radioisotope Heat Source Capsule (LRHSC) Program is developing the technology for a high temperature (> or = to 2000 F), long life (> or = to 5 years) radioisotope heat source which can be used in the space environment. The program is specifically concerned with the development of a tantalum alloy fuel capsule. Materials compatibility, fabrication processes, and assembly procedures are being defined, and the response of the capsule is being determined for conditions of biaxial creep, terminal velocity impact and launch pad abort testing. Results of the LRHSC impact testing are presented. The test program was performed to establish the behavior of the refractory metal capsule upon reentry impact. Twelve LRHS capsules were impact tested at various angles. Upon completion of testing a complete post-test analysis was performed on each capsule. Author (NSA)

N70-34731# Gulf General Atomic, San Diego, Calif.
LATTICE PHYSICAL STUDIES, VOLUME 1 Final Report
G. D. Trimble, T. Gozani, J. M. Neill, P. d'Oultremont and C. A. Preskitt 31 Jul. 1969 293 p refs
(Contract AT(04-3)-167)
(GA-9658-Vol-1; EURAEC-2131-Vol-1) Avail: CFSTI

Research in lattice physics is reported. Included topics are aluminum alloys and systems, design parameters of neutron sources, thermal neutron spectra in various materials, and reactor fuel elements. F.O.S.

N70-34732# Gulf General Atomic, San Diego, Calif.
LATTICE PHYSICS STUDIES, VOLUME 2 Final Report
J. M. Neill, G. D. Trimble, T. Gozani, P. d'Oultremont, and C. A. Preskitt 31 Jul. 1969 51 p refs
(Contract AT(C4-3)-167)
(GA-9658-Vol-2; EURAEC-2131-Vol-2) Avail: CFSTI

Supplemental research to the Lattice Physics Program is reported. The accurate measurement of thermal neutron spectra in plutonium nitrate solution of various concentrations and Pu-240 was studied to obtain an integral check of the relevant cross sections for plutonium, of the scattering kernel for H2O, and the calculational methods used to compute neutron spectra in hydrogenous systems containing plutonium. Measurements were performed in clean geometries to be more sensitive to energy rather than spatial details. Results are tabulated. Author

N70-34750# Oak Ridge National Lab., Tenn.
INDEX TO NUCLEAR SAFETY: A TECHNICAL PROGRESS REVIEW BY CHRONOLOGY, PERMUTED TITLE, AND AUTHOR, VOLUME 1 – 10
J. P. Blakely and Ann Klein Apr. 1970 104 p refs
(Contract W-7405-eng-26)
(ORNL-NSIC-73) Avail: CFSTI

A bibliography of Nuclear Safety articles is presented. The bibliography is separated into three sections: chronological list of articles; permuted title index; and author index. NSA

N70-34751# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
EVALUATION OF MASS SPECTROMETRIC AND RADIOCHEMICAL ANALYSES OF YANKEE CORE 1 SPENT FUEL, INCLUDING ISOTOPES OF ELEMENTS THORIUM THROUGH CURIUM
R. J. Nodvik Aug. 1969 259 p refs
(Contract AT(30-1)-3017)
(WCAP-6086) Avail: CFSTI

Results of mass and alpha spectrometric, X-ray spectrographic, and radiochemical analyses of spent fuel samples irradiated in Yankee – Rowe Cores I, II, and IV are presented. In addition to the analyses for the main chain uranium and plutonium isotopes, analyses for certain other isotopes of the actinide series were performed, including Th-232, Pa-231, U-232, and U-233 in irradiated fuel samples, and U-232, U-233, Np-237, Pu-236, Pu-238,

Am-241, Am-243, Cm-242, and Cm-244 in irradiated fuel samples. A significant aspect of this study is the comparison of the measured isotopic data with results obtained with a matrix exponential calculational method incorporated in the LASER-HIC Computer program. This method uses the ENDF/B cross section data for those isotopes for which such data are available, and calculated cross sections for those isotopes for which such data have not been established. Author (NSA)

N70-34757# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
YANKEE CORE EVALUATION PROGRAM Summary Report
A. P. Suda, L. Chajson, and M. J. O'Boyle Aug. 1969 75 p refs
(Contract AT(30-1)-3017)
(WCAP-6088) Avail: CFSTI

The work performed under the Yankee Core Evaluation Program, the most comprehensive and thorough post-irradiation program ever performed on a spent commercial power-reactor core, is summarized. The specialized equipment and procedures used to ship, examine, and analyze the irradiated Yankee fuel are described. The chemical, metallurgical, engineering, and physics evaluations of the Yankee fuel and cladding are discussed, and the major results of these evaluations are presented. Author (NSA)

N70-34771 National Lending Library for Science and Technology, Boston Spa (England).
DESALINATION: NOTES FROM MOSCOW, NO. 194
25 Feb. 1970 3 p Transl. into ENGLISH from Russian newspaper
(NLL-Trans-194-(6167.650)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Projected is the construction and operation of an atomic power station that will both generate electricity and desalinate sea water. The new installation will operate on neutrons and will be able to desalinate 28,000 cubic meters of sea water a day. G.G.

N70-34776# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
SAXTON PLUTONIUM PROGRAM Semiannual Progress Report, Period Ending 31 Dec. 1969
W. R. Smalley Mar. 1970 55 p refs
(Contract AT(30-1)-3385)
(WCAP-3385-22) Avail: CFSTI

Progress in the development of the utilization of plutonium-enriched fuel in pressurized water reactor systems through design, fabrication, and operation of a partial core of PuO2-UO2 included the destructive examination of samples from the core fuel rods with analysis by mass spectrometry. A one-inch long section of one rod was gamma scanned before and after fuel removal to determine the contribution of the cladding to gross gamma activity. Representative ring sections of cladding were analyzed for hydrogen content and manganese-54 activity, the latter to determine fast flux exposure. Also examined and photomicrographed were 16 additional metallographic samples. Finally high temperature mechanical testing of cladding samples were completed, including 22 tensile tests and 10 burst tests. Author

N70-34780# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FAST FLUX TEST FACILITY Quarterly Technical Report, Dec. 1969–Feb. 1970
B. Wolfe Apr. 1970 175 p refs
(Contract AT(45-1)-1830)
(BNWL-1328) Avail: CFSTI

Technical progress made at the Fast Flux Test Facility includes the development of an idealized digital simulation of the dump heat exchanger with the adoption of a counter-current, concentric tube model using 4-axial and 6-radial nodes. Solid state diffusion methods for attaching Inconel 718 pads to stainless steel ducts were completed. Adequate low level FFTF neutron flux monitoring will be provided by the combination of a variable position, pulse-type, in-vessel neutron monitor and a fixed-position, pulse-type, out-of-vessel neutron monitor. Xenon gas was found to best tag the FTR core to locate failed fuel. NSA

N70-34798# Oak Ridge National Lab., Tenn.
EXPERIMENTAL STUDIES OF THE HEAT TRANSFER AND FLUID DYNAMIC CHARACTERISTICS OF ROD-CLUSTER-TYPE NUCLEAR REACTOR FUEL ELEMENTS
H. W. Hoffman, G. J. Kidd, Jr., F. E. Lynch, W. J. Stelzman, J. L. Wantland et al May 1970 443 p refs
(Contract W-7405-eng-26)
(ORNL-4356) Avail: CFSTI

An extensive experimental study of the thermal-hydraulic characteristics of multirod gas-cooled reactor fuel elements is described. The primary emphasis was on seven-rod fuel-element clusters of the type proposed for the Experimental Gas Cooled Reactor, although several other seven-rod cluster geometries were also examined. Topics studied include pressure drop, velocity distribution, gas mixing, heat transfer, mass transfer, correlations between heat transfer and mass transfer, rod bending, flow visualization, and flow modification. The experiments were performed with air at essentially atmospheric conditions as the working fluid. In the heat transfer tests, both direct and indirect electrical heating were tried, with direct Ohmic heating being selected for the final experiments. The gas-mixing studies utilized helium as the tracer gas, and naphthalene was sublimed in the mass transfer portion of the program. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-33491# Technische Hogeschool, Eindhoven (Netherlands).
RHEOLOGY OF DISPERSED SYSTEMS: INTERPRETATION IN TERMS OF NETWORK STRUCTURE
Johannes Mario Pieter Papenhuijzen (Ph.D. Thesis) 19 May 1970 88 p refs
Avail: CFSTI

A dispersion is defined as a distribution of discrete particles in a Newtonian liquid. In investigating the rheological behavior of dispersions, attractive forces between the particles are assumed, resulting in the build-up of a network structure. A network model is assumed in which the particles are arranged in chains, and during deformation the chains are stretched and the bonds between the particles are broken. Information about structural changes in dispersions of water droplets in oil is obtained by measuring the mechanical and dielectric properties. For a dispersion of fat crystals in oil, a method is used in which the changing dynamic properties are followed with small amplitude oscillations superimposed on a large deformation at constant shear rate. Author

N70-33588# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
ENERGY FLOWS IN MULTI-MODE MEDIA 1 (MULTI-MODE WAVE COUPLING IN INHOMOGENEOUS ANISOTROPIC MEDIA 2)
O. E. H. Rydbeck 1 Jul. 1970 41 p refs
(Grant NSF GP-5611)
(SR-358) Avail: Issuing Activity

Energy flows in wave propagating, multimode media are discussed. The methods used are in principle applicable to wave motions of arbitrary nature and to systems with mixed types of waves, such as electromagnetic and electromechanical ones. The methods described are particularly valuable in the analysis of systems with negative stored energy (for example, masering clouds and whistler-electron stream media in the magnetosphere), which may display interesting and important amplification properties. Author

N70-33737*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CYROGENIC AND SUPERCONDUCTING MAGNET RESEARCH AT THE NASA LEWIS RESEARCH CENTER

W. D. Coles, J. C. Lawrence, and G. V. Brown 20 Nov. 1969 21 p refs Presented at the Am. Inst. of Chem. Eng. Conf., Washington, D.C., 16-20 Nov. 1969

(NASA-TM-X-52627) Avail: CFSTI CSCL 20C

A research and development program to produce strong magnetic fields in large test volumes with minimum weight and power consumption is summarized. A high-field liquid-neon cooled aluminum magnet and various superconducting magnets and their uses are discussed. Superconducting coils for the magnets are wound from ultrapure aluminum, niobium-zirconium, niobium-titanium, and niobium-tin conductors, and have produced fields from 14.0 to 20.0 tesla. Author

N70-33778*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

PRINCIPLES OF OPTICAL DATA PROCESSING FOR ENGINEERS

A. R. Shulman Washington May 1970 126 p

(NASA-TR-R-327) Avail: CFSTI CSCL 20F

Fundamental are reviewed and expanded upon to give a clear understanding and working knowledge of optical data processing, including: optical spectrum analysis, optical correlation, photographic film characteristics, and holography. In addition, the mathematics to describe the various optical operations are introduced, forming a background for understanding more advanced works in the field. Author

N70-33864*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

SONIC BOOM SIMULATION BY MEANS OF LOW-PRESSURE SOURCES

Ulrich J. Kurze, Richard E. Hayden, Richard Madden, Clay H. Allen, and Eric E. Ungar Mar. 1970 135 p refs

(Contract NAS1-9312)

(NASA-CR-66969) Avail: CFSTI CSCL 20A

Theoretical and experimental results are presented which indicate that N-waves approximating full-scale sonic booms can be obtained from low-pressure pulses applied at the throat of a horn. Conical horns are shown to be optimum and to confine radiation of waves with sharp pressure discontinuities to within the cone angle. It is determined that exposures of a 1000 ft diameter test site to a simulated sonic boom requires a horn which is roughly 1000 ft long, and has a 300 ft mouth diameter and a throat diameter of about 20 ft, and is located so that its mouth is 2500 ft from the edge of the test site. Peak velocities in the throat corresponding to Mach numbers below 0.5 then can produce N-waves with amplitudes of 140 to 148 dB. Author

N70-33918# Honeywell, Inc., Seattle, Wash. Marine Systems Center.

RESEARCH PROGRAM IN ACOUSTIC REVERBERATION Annual Technical Report, 1 Apr. 1969 – 31 Mar. 1970

Robert L. Swarts 14 Apr. 1970 76 p refs

(Contract N00014-69-C-0317)

(AD-705630; Rept-2147-Rev) Avail: CFSTI CSCL 20/1

In experiments in the Straits of Juan de Fuca, north of Seattle, Washington, sequential reverberation records were produced using pulsed continuous wave signals and a vertically-oriented, bottom-mounted, narrow-beam transducer. Several-hundred-pulse sequences were transmitted on the hour for 250 consecutive hours. The resulting reverberation was demodulated in quadrature and recorded on analog tape. The tapes were returned to the laboratory and digitized. Estimates of data parameters were then obtained using ensemble averaging techniques and the behavior of the estimates as a function of time was studied. Special attention was given to the determination of probability density functions, detection of environmental nonstationarity by testing the data for statistical inhomogeneity, and isolation of spatial-temporal patterns in the volume back-scattering strengths. Volume scattering strengths for the whole 250-hour period were obtained as a by-product of the latter activity. Diurnal variations as well as higher frequency space-time changes are clearly indicated. Author (TAB)

N70-33919# Syracuse Univ., N.Y. Dept. of Physics.

A STUDY OF NULL SURFACES IN GRAVITATIONAL THEORY Final Technical Report, Nov. 1966 – Dec. 1969

Joshua N. Goldberg Wright-Patterson AFB, Ohio ARL Jan. 1970 85 p refs

(Contract F33615-67-C-1182)

(AD-705632; ARL-70-0003) Avail: CFSTI CSCL 20/10

The unifying element of almost all the research topics discussed in this report is the use and importance of null surfaces in general relativity. However, the research topics themselves are more varied ranging over the question of radiation, the Newman-Penrose constants, equations of motion, and quantum field theory. The report itself consists of a brief introduction describing the basic problems under consideration and then a section in which detailed papers or reports are presented. Author (TAB)

N70-34075# Naval Research Lab., Washington, D.C.

AN UPPER LIMIT ON THE THERMAL DEFOCUSING OF A LIGHT BEAM

Herbert B. Rosenstock and James W. Tucker Apr. 1970 7 p refs

(AD-705485; NRL-MR-2109) Avail: CFSTI CSCL 20/6

The authors discuss the defocussing of a light beam due to the heating of the atmosphere caused by the beam itself. Under certain assumptions, the calculation of the intensities a long distance from the source (far-field pattern) is very simple, and does not involve the tracing of individual rays through the intermediate region. Of the assumptions made, that requiring the absence of wind and convection is physically the most severe one; all assumptions tend to increase the size of the pattern calculated, so that the result is an upper limit to the real situation. A general expression for the far-field pattern is obtained, which is easily evaluable in terms of any assmued initial power profile. However, the gross features, and particularly the size, of the far-field pattern is found to be only slightly dependent on the details of the profile. For a given power density, the size of the far-field pattern is independent of the original beam radius. Author (TAB)

N70-34171# Stanford Univ., Calif. Dept. of Physics.

FUNDAMENTAL EXPERIMENTS AT LIQUID HELIUM TEMPERATURES Final Scientific Report

William M. Fairbank and William O. Hamilton Dec. 1969 12 p refs

(Grant AF-AFOSR-1771-69; AF-AFOSR-1366-68)

(AD-701773; AFOSR-69-3088TR) Avail: CFSTI CSCL 20/13

Low temperature techniques have been applied to a wide variety of physical phenomena. The research has been directed toward the measurement of the electric dipole moment of the He(3) nucleus and the development of a free precession nuclear gyroscope, the examination of the nature of phase transitions by light scattering from helium at the critical region and toward the measurement of

g-2 of the electron and positron and the development of a detector of single photons in the microwave and infrared region of the spectrum. The experiments and progress to date are briefly described. Author (TAB)

N70-34204# Optics Technology, Inc., Palo Alto, Calif.
DIFFRACTION AND COHERENCE PHENOMENA IN OPTICAL WAVEGUIDES Final Report
N. S. Kapany 31 Dec. 1969 15 p
(Contract AF 49(638)-1626)
(AD-705250; AFOSR-70-0140TR) Avail: CFSTI CSCL 20/6

The research effort has been a continuation of a theoretical and experimental investigation into problems of diffraction and coherence phenomena in dielectric waveguides. In order to yield a deeper understanding into a number of basic phenomena pertaining to radiation, coherence, and coupling effects in active as well as passive fibers, investigations have been carried through several stages, ranging from studies of small diameter diffraction apertures to waveguide mode propagation in isolated fibers, coupling effects in arrays of fibers, and radiation characteristics of such fibers separately in the active or the passive mode. Author (TAB)

N70-34208# Naval Oceanographic Office, Washington, D.C.
UNDERWATER VISIBILITY OF OBJECTS IN OPEN WATER BASINS [PODVODNAYA VIDIMOST' OBYEKTOV V OTKRYTYKH VODOYEMAX]
O. A. Sokolov 1970 18 p refs Transl. into ENGLISH from Okeanologiya (Moscow), v. 4, no. 4, 1964 p 564–573
(AD-705816; NOO-Trans-259) Avail: CFSTI CSCL 17/8

Light equations of stationary regime of plane-parallel turbid medium are derived; they show the dependence of brilliance of light fog, which is supperimposed over the brilliance of object and background in water medium with a stationary distribution of brilliance, upon optical indices of the medium, the distance and direction of observation. With the aid of these equations, a formula defining the attenuation of contrasts in water medium is derived. The formula demonstrates that the attenuation of contrast occurs in accordance with the exponential law in which the index depends upon the direction of observation. Author (TAB)

N70-34262# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Mechanical Engineering.
THEORETICAL AND EXPERIMENTAL RESEARCH IN ELECTROKINETICS
D. Burgreen, D. Hildreth, P. F. Richiuso, A. Notaro, R. Bilenchi et al Jan. 1970 132 p refs
(Grant NSF GK-1941)
(PB-190283; PIBME-70-01) Avail: CFSTI CSCL 20C

A study was made of electro-osmotic flow and streaming potential generation in fine capillary slits, taking into account the presence of a distributed conductance across the capillar channel, and the effect of the differences in the ionic mobilities of the co-ions and counter ions. A comparison of the theoretical results obtained in the present analysis, with experimental data obtained by previous investigators, shows good agreement. The apparent increase in viscosity that is observed in experiments with fine capillaries, is shown to be a natural flow retardation that is obtained from equilibrium-continuum considerations in ultrafine capillary systems. Author (USGRDR)

N70-34283# Scripta Technica, Inc., Washington, D.C.
PULSED LIGHT SOURCES
I. S. Marshak Mar. 1970 275 p refs Transl. into ENGLISH of THE BOOK 'Impulsnyye Istochniki Sveta' Moscow, Gosenergoizdat, 1963 p 1–336
(Contract N00173-70-C-0026)
(AD-704944; NRL-Trans-1210) Avail: CFSTI CSCL 13/1

The book discusses problems in the physical theory of a pulsed discharge, the radiation of a pulsed discharge, and the principal parameters and structural aspects of pulsed gas-discharge light sources. These light sources have found wide application in electronics and automation, in optical communications, in photography and cinematography, in printing, etc. Typical wiring diagrams for pulsed light sources are presented. Author (TAB)

N70-34485# Kharkov Inst. of Aviation (URSR).
THE EFFECT OF THE MATERIAL PROPERTIES OF A PERMANENT MAGNET AND CERTAIN GEOMETRIC PARAMETERS ON THE BREAKAWAY FORCE IN A MAGNETIC CLAMP
V. V. Bandurin, N. I. Sitas, V. V. Bazilevskiy (Akad. Nauk URSR, Kiev), and V. V. Kozorez (Akad. Nauk URSR, Kiev) *In* Akad. Nauk URSR Probl. on Theory and Analysis for Converter Device Technol. 1968 p 189–195 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The states of the magnet are distributed in the return sections, and the nonlinear functions between the magnetic inductance and field intensity in the magnetically soft parts of the clamp are identical. The breakaway force depends on the material properties of the magnet, the total magnetic resistance of the circuit, and the rate of change of the resistance as the gap varies. Calculating functions are derived for the various geometrical configurations and breakaway force. Transl. by R.B.

N70-34486# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
CALCULATING THE REPULSIVE FORCE OF ANNULAR AND SPHERICAL PERMANENT MAGNETS
V. V. Bazilevskiy *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 196–203 ref In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The magnets have a common axis of symmetry and adjacent like poles. It is assumed that the isotropic material of the permanent magnet follows the basic curve of demagnetization corresponding to the operating line of the return. This permits consideration of the magnetic flux tube for any negligible element of the magnet as a source of magnetomotive force. The total resistance of magnetic flux for each element is calculated by the derived formulas. Transl. by R.B.

N70-34488# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
THE SURFACE IMPEDANCE OF A SHIELDED FERROMAGNETIC HALF SPACE
A. N. Kravchenko and G. I. Kalayda *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 215–220 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The reduced magnetic permeability of a layered medium, consisting of a conducting layer with constant parameters and a nonlinear ferromagnetic half space, is considered. Formulas are derived and a graph is constructed for the dependence of reduced magnetic permeability on the field intensity at the shield surface and on the parameters of the ferromagnetic half space and the shield. Transl. by R.B.

N70-34489# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
EQUIVALENT MAGNETIC PERMEABILITY
I. Ya. Podchernyayev *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 221–224 refs In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

A comparison is made of equivalent magnetic permeability measured in an alternating field and calculated by the ballistic method for a group of symmetrical static hysteresis loops. The

comparison shows that the values of equivalent magnetic permeability derived from the given formulas and those of measured magnetic permeability in the alternating field are different, due to the fact that the measurements in the alternating current field were made in a model of finite dimensions, while the results of the measurements were developed by formulas derived for an infinite half space. Transl. by R.B.

N70-34492# Akademiya Nauk URSR, Kiev. Inst. Elektrodinamiki.
EXPERIMENTAL DETERMINATION OF THE STABILITY OF A MAGNETIC SUSPENSION DEVICE IN THE RADIAL DIRECTION
L. Z. Piven *In its* Probl. on Theory and Analysis for Converter Device Technol. 1968 p 238-242 In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

The dependence of the initial rigidity of an axisymmetrical magnetic suspension device in the radial direction on the shape of the supported body is considered. The rigidity of the suspension device is determined from the oscillations of the pendulum. It is assumed that the center of application of the electromagnetic force is located at the vertex of the ferromagnet, that oscillations do not exceed several millimeters, and that the oscillating frequency does not exceed 2 Hz. A set of curves is plotted for each of four shapes of ferromagnets, and the curves show that the rigidity of the device decreases as the gap is increased and the current is reduced in the electromagnet. Transl. by R.B.

N70-34494# Kiev Polytechnic (USSR).
USING AN ANALOG COMPUTER TO APPROXIMATE THE CURVE OF MAGNETIZATION
I. Ye. Kovalenko *In* Akad. Nauk URSR Probl. on Theory and Analysis for Converter Device Technol. 1968 p 247-249 ref In RUSSIAN (See N70-34458 18-10)
Avail: CFSTI

A minimum mean square error is required to plot a finite, previously selected number of points on an experimental magnetization curve. A method of calculating the approximation parameters is considered, which is based on requirements for a minimum mean square error with constant variation of induction at the interval of zero and the maximum value of induction. An example is given for a specimen of cold-rolled steel to illustrate the validity of the method. Transl. by R.B.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-33411# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
BROKEN NONLINEAR CHIRAL U(3) x U(3) AND SU(3) x SU(3) DYNAMICS OF HADRONS AND THEIR COROLLARIES
V. I. Sabo and Yu. M. Lomsadze 1969 24 p refs
(ITF-69-82) Avail: AEC Depository Libraries

Broken nonlinear chiral U(3) x U(3) and SU(3) x SU(3) dynamics are built for low-energy strong, electromagnetic and weak interactions of the multiplets B, P, V, and A. Predictions of both dynamics can be estimated to be in satisfactory agreement with experiment for all decays and scatterings up to energies 40 MeV in L-frame. Author (NSA)

N70-33416# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Reaktorzentrum.
LEAST SQUARES ADJUSTMENT OF THE COUPLING CONSTANTS IN BETA DECAY
H. Paul 1970 30 p refs Submitted for publication
(SGAE-PH-91/1970) Avail: CFSTI

The best values of the coupling constant ratios from all relevant measurements on allowed decays (75 data), by a least squares adjustment program are determined. With two exceptions, no assumptions on matrix elements are made, i.e., only neutron decay and pure Fermi or Gamow-Teller transitions are used. Author

N70-33420# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
DIGITIZING PLANAR REGIONS FOR MONTE CARLO TRANSPORT PROBLEMS
A. De Matteis 14 Oct. 1969 11 p refs
(RT/FIMA(69)6) Avail: CFSTI

By digitizing planar regions, the geometrical part in the tracing of particle life histories in Monte Carlo transport problems becomes very simple. Algorithms are described for the simulation of particle free-flights and some results are presented. Author

N70-33423# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina). Lab. de Radiaciones.
X-RAY SPECTROSCOPY RELATED TO THE DETERMINATION OF ELECTRON-CAPTURE RATIOS
H. E. Bosch, M. A. Fariolli, N. Martin, and M. C. Simon 1969 32 p refs Sponsored in part by Fund for Overseas Res. Grant and Educ., Inc. (US)
(CNIE-IC-2) Avail: CFSTI

The methods employed for measuring LM/K capture ratios were analyzed and the corresponding data were compiled in different tables. An alternative method is introduced using very thin NaI(Tl) crystals to detect X-rays, in conjunction with Ge(Li) counters for gamma-rays. A triple coincidence arrangement was used. Calibration in energy and absorption corrections were made. The particular transitions of Ba-133 to Ce-133 (437 keV level), Co-57 to Fe-57 (136 keV level), and Co-57 to Fe-57 (706 keV level) were studied. The values of the LM/K ratios obtained were 1.15 + or - 0.08, 0.15 + or - 0.02, and 0.088 + or - 0.040 respectively. When possible, Q-values were derived from the data obtained and compared with mass-table predictions. Author

N70-33433# Institute of Nuclear Research, Krakow (Poland).
POSSIBILITIES OF USING NUCLEAR TARGETS IN INVESTIGATIONS OF HADRONIC INTERACTIONS AT HIGH ENERGIES
W. Czyz 1969 17 p refs Presented at 3d Intern. Conf. on High Energy Phys. and Nucl. Struct., New York, 8-12 Sep. 1969
(INP-686; CONF-690914-8) Avail: AEC Depository Libraries

Interference between the Coulomb and strong interactions in the hadron-nucleus elastic scattering amplitudes is employed to extract the ratio of the real to imaginary part of the hadron-nucleon elastic scattering amplitude. Comparison with the 20 GeV proton-nuclei elastic and almost elastic scattering data is given. Author (NSA)

N70-33437# Institute of Nuclear Physics, Krakow (Poland).
ROLE OF COULOMB INTERACTIONS IN ELASTIC AND ALMOST ELASTIC SCATTERING OF HADRONS FROM NUCLEI
W. Czyz, L. Lesniak, and H. Wolek Nov. 1969 73 p refs
(INP-687) Avail: AEC Depository

An analysis of the role of Coulomb interactions in the high energy nuclear scattering processes without meson production is given. The high energy scattering model of elastic and nuclear inelastic sum rules scattering is tested on the available experimental material. Special attention is paid to the problem of extracting from the hadron-nucleus cross-sections the real parts of the hadron-nucleon elastic scattering amplitudes. Author

N70-33438# Institute of Nuclear Research, Warsaw (Poland).
LEVELS IN THE CLOSED NEUTRON SHELL NUCLIDE SM 144
J. Kownakci, Z. Sujkowski, L. E. Froeberg, H. Ryde, and I. Adam 1969 5 p refs Presented at Intern. Conf. on Properties of Nucl. States, Montreal, Aug. 1969
(INR-1109; CONF-690804-18) Avail: AEC Depository Libraries

Energy, angular and time distributions are measured for gamma rays deexciting states in Sm nuclei populated in (alpha, xn) reactions with even Nd targets. The level structure of Sm-144 is discussed and compared with that for other N = 82 even Z isotopes. NSA

N70-33441# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
PHOTOPRODUCTION OF THE NEUTRAL VECTOR MESONS ON THE LIGHT NUCLEI
A. I. Akhiezer and M. P. Rekalo 1969 12 p refs In RUSSIAN; ENGLISH summary Presented at High Energy Phys. and Theory of Elementary Particles, Kiev.
(ITF-69-87; CONF-691035-2) Avail: AEC Depository Libraries

Coherent photoproduction of the neutral vector mesons on the nuclei D, He-3, and H-3 is discussed in terms of the Regge-pole and quark models. The experimental value of the ratio of neutral rho meson photoproduction cross sections on the deuteron and proton is explained only in the Regge-pole model. From the models mentioned above, it is predicted that the ratios of omega-photoproduction cross sections on the nuclei D, He-3, and H-3, and the omega mesons photoproduction cross section on the proton should be essentially less than the ratios, predicted for the straight diffraction omega mesons production. Author (NSA)

N70-33454# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
ACCURACY OF dg/dT FOR FISSILE ISOTOPES, WITH REFERENCE TO ENDF/B (AND OTHER) DATA FILES
C. H. Westcott Apr. 1970 32 p refs
(AECL-3605) Avail: CFSTI

The accuracy of the g-factors (for 20 C) for the nuclides U-233, U-235, Pu-239 and Pu-241 and the regression analysis of the 2200 m/sec constants are studied for the same isotopes. It appears desirable to estimate the possible inaccuracies of the g's at temperatures above 20 C, i.e., of the effective cross sections for Maxwellian (and thence for thermal-reactor) spectra for the same isotopes. It was found, and confirmed by typical lattice calculations, that this uncertainty in dg/dT gives rise to a significant contribution when a reactor temperature coefficient is evaluated, although it does not represent a major increase over previously-estimated errors. Author

N70-33468# Akademiya Nauk URSR, Kiev. Institut Teicheskoi Fiziki.
ONE PION AND DIFFRACTION COMPETITION IN NUCLEON RESONANCES PRODUCTION PROCESSES
M. P. Rekalo 1969 12 p refs In RUSSIAN Presented at Conf. on High Energy Phys. and Theory of Elementary Particles, Kiev
(ITF-69-86) Avail: AEC Depository Libraries

The influence of a one-pion mechanism on the energy dependence of total cross sections of processes p + p yield p + N* is discussed. It is shown that the one-pion contribution is small for reaction p + p yields p + N* (1470) in comparison with diffraction contribution in the region of a moderate high energies (momentum of the initial particle is less 10 BeV/c). The one-pion contribution for the preaction p + p yields p + N*(1518) equals the diffraction contribution for the moderate high energies that result in minimum for the energy dependence of the total cross section of this process. It is predicted, that the maximum must be absent in the energy dependence of the total cross sections of the production isotopic spin 1/2 resonances N* in reactions positive or negative pion + proton yields positive or negative pion + N*, positive or negative kaon + proton yields positive or negative kaon + N* at moderate high energies: the cross sections must achieve their asymptotic values smooth. Author (NSA)

N70-33475# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
RECOIL EFFECTS DUE TO MASS DIFFERENCES AND THE QUARK MODEL OF DIFFRACTIVE PRODUCTION OF N (1470, 1690)
A. Le Yaouanc, L. Oliver, O. Pene, and J. C. Raynal May 1970 23 p refs
(Rept-70/23) Avail: CFSTI

Using the scalar quark-quark amplitudes and the radii of the hadrons, fitted from elastic scattering, the production of N*+(1470,1690) by pion, p, e on protons is described. The Glauber model is modified to include recoil effects. Contrary to an earlier partial study it is shown that single scattering dominates strong forward production, and it peaks at t, or GeV squared, = 0 with a slope smaller than the elastic one. For the N*(1690), the shapes of the theoretical curves are good as long as data are available over a sufficient range of t, the absolute values are too large by a factor 1.5 – 3. On the contrary, important features of the N* (1470) (forward spike in strong production, absence of electroproduction) are not explained although there is a qualitative agreement with data for strong production at $0.1 < t < 0.5$. Author

N70-33476# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
A PHENOMENOLOGICAL ANALYSIS OF PROTON-PROTON SCATTERING FROM 50 TO 1000 MeV
Arnaud Chastel Mar. 1970 58 p refs
(Rept-7012) Avail: CFSTI

A relativistic theory is given of the p p yields p p reaction from 50 to 1000 MeV. The usual meson exchange theory is taken as the left-hand cut of the Mandelstam plane. At these energies the only important channels are p p yields p p, p p yields N N pion, and p p yields d pion. The right-hand cut contribution is computed. The corresponding N/D inelastic equations are solved. The agreement with experimental results is reasonably good. The theory now gives a firm basis to reevaluate the parameters of the left-hand cut. Author

N70-33483# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
HIGH MULTIPLICITY HADRONIC INTERACTIONS: THE PROBLEM OF DATA PRESENTATION Review Talk
A. Krzywicki May 1970 21 p refs Presented at the Colloq. on High Multiplicity Interactions, Paris, 13-15 May 1970
(Rept-70/19) Avail: CFSTI

The present state of the art problem of data presentation in the study of particle production phenomena is reviewed. The dynamical effects reflecting the structure of the collision amplitude, from the kinematical effects, which in the case of multiple production are pertinent, are emphasized; as well as the methods used to differentiate between the dynamics and the phase-space effects. The distribution of the invariant momentum transfer from the initial to the final proton which strongly depends on multiplicity is cited. E.M.C.

N70-33493# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimentalnoi Fiziki.
CONCERNING THE BREMSSTRAHLUNG SPECTRUM IN DIRECT NUCLEAR REACTIONS
L. A. Kondratyuk 1969 35 p refs In RUSSIAN; ENGLISH

summary
(ITEF-660) Avail: AEC Depository Libraries

The possibility of using the bremsstrahlung spectrum in direct nuclear reactions for identification of reaction mechanisms is discussed. The amplitudes of radiative transitions for particles with arbitrary spins in nonrelativistic limit are calculated in the soft-photon approximation when only charge radiation of particles and contact radiation in vertices are taken into account. The bremsstrahlung spectrum is calculated for the pole and triangle mechanism and is shown to have appreciable qualitiative distinctions in both these cases. Criteria for applicability of the method are derived. Author (NSA)

N70-33494# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimentalnoi Fiziki.

POLAR APPROXIMATION IN INTEGRAL EQUATIONS FOR FOUR PARTICLES

I. M. Narodetskii 1969 24 p refs In RUSSIAN; ENGLISH summary
(ITEF-672) Avail: AEC Depository Libraries

The pole approximation in the Faddeev–Yakubowski equations is discussed. This approximation can be applied to four-particle nucleus, consisting of a core plus one nucleon. The equations are derived taking into account the spins and isobaric spins in one case S = Y = 0. The kernels of this equations contain three-particle one-channel Faddeev functions. The relation of this function with that obtained using the K-harmonic method is discussed. It is shown the equation describing exited states of He-4 consists of experimental magnitudes: the bound state energy and charge formfactor of H-3 when one takes into account the K = 0 harmonic in the three-particle wave function only. Author (NSA)

N70-33510# Central Research Inst. for Physics, Budapest (Hungary).

ON THE THEORY AND PRACTICE OF DENSITY CORRECTION CONCERNING NEUTRON MOISTURE MEASUREMENT

A. Z. Nagy, P. Vertes, E. Vegh, and F. Kosa 1969 10 p refs
(KFKI-34/1969) Avail: AEC Depository Libraries

Dry bulk density corrections for neutron radiometric moisture measurement are discussed. A double scintillation detector and a pulse-shape discriminator are used for gamma and neutron detection. Calculated and measured results are given. NSA

N70-33522# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

A MODEL FOR THE POMERANCHUK TERMS

M. Greco 26 Nov. 1969 10 p refs *Its* Nota Interna No. 458
(INF-69/71) Avail: CFSTI

A model for all the Pomeranchuk terms is constructed by taking into account some general properties associated to the leading vacuum singularity. It gives a good description of the total and differential cross sections, and provides an accurate determination of the Pomeranchuk parameters. Author

N70-33530# Akademiya Nauk URSR. Kiev. Inst. Teoreticheskoi Fiziki.

SHOWER PRODUCTION RESCATTERING AND INCREASE OF TOTAL CROSS SECTIONS AT E APPROACHES INFINITY

A. I. Lendel and K. A. Ter-Martirosyan 1969 12 p refs In RUSSIAN; ENGLISH summary
(ITF-69-89) Avail: AEC Depository Libraries

The data on the total cross sections obtained at the Serpukhow accelerator are discussed. It is shown that the good agreement with the experiment can be obtained in frame of the complex momentum theory if the effect of the showers production at rescattering is taken into account. Author (NSA)

N70-33531# Akademiya Naul URSR. Kiev. Inst. Teoreticheskoi Fiziki.

PHOTOPRODUCTION OF NEUTRAL PSEUDOSCALAR MESONS IN MODEL TAKING INTO ACCOUNT POLES, CUTS AND CONSEQUENCES OF HIGH SYMMETRIES

N. A. Kobylinskii 1970 17 p refs In RUSSIAN; ENGLISH summary
(ITF-70-1) Avail: AEC Depository Libraries

A theoretical model is considered founded on taking into account the contributions of rho and omega Regge poles and cuts, corresponding to simultaneous exchange in t–channel by one of these poles and vacuum pole. Use of SU(3)–symmetry, vector dominance model and quark model essentially decreases the number of parameters which, in turn, allows one to obtain a number of simple relations between asymmetries, differential cross sections of meson production by polarized and unpolarized photons and polarizations of recoil nucleons for the processes of photoproduction of pi and eta mesons on protons and neutrons at high energies and small momentum transfer. The obtained relations agree with the present experimental data. The importance is noted of measuring polarization of recoil nucleons and asymmetries of angular distributions of mesons to verify the assumptions in the foundation of a considered model. Author (NSA)

N70-33535# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

DEVELOPMENT OF EQUIPMENT FOR THE STUDY OF HIGH-ENERGY-PARTICLE ELASTIC SCATTERING OVER A WIDE ANGULAR RANGE [REALISATION D'UN APPAREILLAGE DESTINE A L'ETUDE DES DIFFUSIONS ELASTIQUES SOUS TOUS LES ANGLES DE PARTICULES DE HAUTE ENERGIE]

Jacques Berger (Ph.D. Thesis—Paris Univ.) Jun. 1969 109 p refs In FRENCH
(CEA-N-1258) Avail: Issuing Activity

The equipment for a series of experiments performed in the CERN proton synchrotron in Geneva, in order to study pion proton, kaon proton, and antiproton proton elastic scatterings for lab. angles between 5 and 175 deg and for incident momenta of about 3.5 GeV/c, is presented. The apparatus includes detectors (thin plate optical spark chambers and associated counters) as well as the electronic logics to select the scattering events. A gas Cherenkov counter with a large cross-sectional area approximately 1 sq m and diffusing walls is studied in detail. The differential elastic scattering cross sections obtained are given. NSA

N70-33537# Akademiya Nauk URSR. Kiev. Institut Teoreticheskoi Fiziki.

VECTOR DOMINANCE, CURRENT CONSERVATION AND THE REACTION PION NUCLEON YIELDS RHO-MESON NUCLEON AT HIGH ENERGIES

N. N. Achasov and G. N. Shestakov 1969 16 p refs Presented at High Energy Phys. and Theory of Elementary Particles, Kiev.
(INF-69-70) Avail: AEC Depository Libraries

The pole vector-dominance model is formulated for invariant amplitudes. It is shown that the assumption of independence of the vesto meson mass, the invariant amplitudes, and the current conservation condition lead to relations among t-channel helicity amplitudes. These relations are studied for the reaction pion neutrino yields rho meson neutrino in various Regge models. In the Regge pole model with pion, omega meson, and A sub 2 exchange relations connecting the spin density matrix elements for the rho meson are obtained. These can be tested experimentally. For the reaction negative pion proton yields rho meson proton at 9 GeV/c the agreement with experiment is quite satisfactory for not too small values of /t/. Author (NSA)

N70-33540# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
STUDY OF THE INTERACTION PION PION AND TESTS OF THE CHARGE CONJUGATION INVARIANCE OF THE REACTION POSITIVE ELECTRON NEGATIVE ELECTRON YIELDS POSITIVE PION NEGATIVE PION GAMMA (PRELIMINARY PROPOSAL) [STUDIO DELL'INTERAZIONE PION PION E TESTS DELLA INVARIANZA PER CONIUGAZIONE DI CARICA NEL PROCESSO POSITIVE ELECTRON NEGATIVE ELECTRON YIELDS POSITIVE PION NEGATIVE PION GAMMA (PROPOSTA PRELIMINA RE)]
B. Stella 5 Dec. 1969 17 p refs In ITALIAN; ENGLISH summary
(LNF-69/77) Avail: CFSTI

Possible experiments concerning scalar-isoscalar mesons and charge conjugation invariance are considered. A colliding beam experiment on the process of positron, electron yields positive pion, negative pion, gamma for studying pion-pion interactions and C-violating effects is discussed. Author

N70-33541# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
ANALYTICAL REGULATION IN THE LEE MODEL FOR POSITIVE-DEFINITE AND INDEFINITE METRICS [ANALYTISCHE REGULARISIERUNG IM LEE-MODELL BEI POSITIV-DEFINITER UND INDEFINITER METRIK]
Dietrich Grosser (Ph.D. Thesis) Jan. 1970 47 p refs In GERMAN
Avail: CFSTI

Analytical regularization is applied in the Lee model with positive defined and in undefined metrics in order to find a formulation without cut-off function. The V particle propagator is calculated for interaction representation with the help of perturbation theory and analytical regulated. Obtained are four differing cases depending on the appearing parameters. All four lead to contradictions with positive defined metrics, and in one case the regulating propagator is equivalent to the usual propagator that delivers the renormalization. Use of the undefined metrics does not give contradictions; in the case of a dipole the regulatory propagator is equivalent with the one obtained when a cut-off parameter is introduced that is infinite at terminus. Transl. by G.G.

N70-33544# Georgetown Univ., Washington, D.C.
SEMIEMPIRICAL AND APPROXIMATE METHODS FOR MOLECULAR CALCULATIONS: BIBLIOGRAPHY AND KWIC INDEX
George A. Henderson and Sandra Frattali 1 December 1969 293 p refs
(Contract NBS-CST-372; Proj. Defender)
(AD-705110; NBS-OSRDB-70-3) Avail: CFSTI CSCL 7/4

In recent years a great many calculations on vibrational energy transfer have appeared in the literature. Since most of the calculations have been done for a one-dimensional atom-diatom exponential interaction, a large amount of data has accumulated that is easy to categorize. In the present compilation, therefore, we limit ourselves to these calculations. Specifically, only those results are included that refer to the system A---B - C with an exponential interaction between A and B and a harmonic interaction between B and C. This problem can be completely specified with the incident relative energy of A and B - C, a potential parameter, and a single mass parameter defined in the text. Collisional transition probabilities are tabulated as a function of these three parameters and the oscillator quantum numbers. Author (TAB)

N70-33545# Oak Ridge National Lab., Tenn.
GAMMA-RAY SPECTRA ARISING FROM FAST-NEUTRON INTERACTIONS IN ELEMENTS FOUND IN SOILS, CONCRETES, AND STRUCTURAL MATERIALS
R. E. Maerker and F. J. Muckenthaler Apr. 1970 242 p refs
(Contract W-7405-eng-26)
(AD-704792; ORNL-4475) Avail: CFSTI CSCL 18/6

Experimental data are presented for the production of secondary gamma rays arising from the interaction of a fission-like spectrum of fast neutrons with oxygen, carbon, iron, aluminum, copper, zinc, titanium, nickel, silicon, calcium, potassium, sodium, barium, sulfur, and a stainless steel. These data are useful in evaluating the accuracy of (n,x gamma) cross-section sets. The data are differential in the gamma-ray energy from 1 MeV to approximately 6.5 MeV and are expressed as values for 4 pi times the average differential gamma-ray production cross section at 90 deg to the incident neutron beam for all neutrons in the beam lying above 1 MeV. These results are estimated to have an accuracy of plus or minus 30% and include the contribution from both discrete and continuum gamma rays. Very approximate experimental data are presented for gamma rays arising from resonance capture of neutrons from a 1/E energy spectrum in the energy range 10-200 keV. Author (TAB)

N70-33562# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
TWICE LOGARITHMIC ASYMPTOTIC BEHAVIOR OF THE AMPLITUDE OF ANNIHILATION ELECTRON-POSITRON YIELDS NEUTRON GAMMA
E. A. Kuraev and A. F. Kalinichenko 1969 14 p refs In RUSSIAN; ENGLISH summary
(ITF-69-88) Avail: AEC Depository Libraries

An expression is obtained for the asymptotic behavior of the amplitude of annihilation of an electron-positron pair in an arbitrary number of photons at high energies in the center-of-mass system providing that two hard photons in a finite state which carry almost all energy of the pair are emitted in the direction of the initial particles and the remaining photons are emitted arbitrarily; the photons are polarized perpendicular to momenta positron electron. Author (NSA)

N70-33563# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
TWO BODY COULOMB SINGULARITIES IN THE EQUATIONS FOR THREE CHARGED PARTICLES
A. M. Veselova 1969 10 p refs Presented at Conf. on the Theory of Small Nucleon Systems, Kiev, Jun. 1969
(ITF-69-85) Avail: AEC Depository Libraries

The system of three charged particles is considered. The regular system of the integral equations for the bound state scattering problem below the ionization threshold is obtained. The kernels of these integral equations are expressed in terms of the solutions of two-body problems only. Author (NSA)

N70-33579# Institute of Nuclear Physics, Krakow (Poland).
PROCEEDINGS OF CRACOW SCHOOL OF THEORETICAL PHYSICS NO. 9, VOLUME 1
Jun. 1969 241 p refs Conf. held in Kalatowki, Poland, Supported in part by State Council for Peaceful Uses of Nucl. Energy
(INP-681) Avail: AEC Depository Libraries

Summaries are presented for lectures on experiments with the CERN boson spectrometer and the quark model, the Veneziano model of scattering amplitude, the theory of 2 pion interaction, current algebra on the mass shell, dispersion relations, and pion-nucleon scattering, the binding energy of a gamma particle in nuclear matter, CP violation and particle mixture models, nonlinear realization and breaking of SU(3) symmetry, physical symmetries in quantum field theory, quantum Markov processes in quantum mechanics, the quasipotential method in the bound state problem, and the phase operator in scattering theory. NSA

N70-33581# Tokyo Univ. (Japan). Inst. for Nuclear Study.
INSTITUTE FOR NUCLEAR STUDY Annual Report, Apr. 1968 - Mar. 1969
1 Jul. 1969 104 p refs
(NP-18091) Avail: AEC Depository Libraries

Progress is reported on research on angular distributions for proton reactions and alpha elastic scattering in Al-27, Ba-138, Cd-114, Cd-116, Ca-40, Ca-42, Mg-26, Mo-92, Nd-142, Si-28, Si-29, Si-30, W-182, W-183, and W-184; reactions of cosmic ray particles with carbon and lead in nuclear emulsion chambers; operation of multiple detectors in cosmic ray telescopes for cosmic shower studies; design and use of multiple sandwich nuclear emulsions for cosmic ray detection and development of cyclotrons, synchrotrons, and synchrocyclotrons. NSA

N70-33684# Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares.
ON DETERMINING THE WATER IN MATERIALS BY NEUTRONS [SOBRE A DETERMINACAO DO TEOR DE AGUA EM MATERIAIS POR MEIO DE NEUTROES]
E. Martinho and F. Carvalho 1970 14 p refs In PORTUGUESE
(LFEN-N1.50-a) Avail: CFSTI

A method is described for determining the moisture content in materials based on the moderation of fast neutrons by the hydrogen of the water. As the counting rate for slow neutrons varies greatly with the amount of moisture in the medium, the water content can be determined very accurately. Results of applying the method to clay soils are included. Transl. by F.O.S.

N70-33698# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ERROR DUE TO PULSE PILING-UP IN THE MEASUREMENTS OF AMPLITUDE SPECTRA AND ERROR DIMINISHING BY MEANS OF PILE-UP INSPECTIONS. REVIEW
B. Yu. Semenov 1970 31 p refs In RUSSIAN
(JINR-P13-4899) Avail: AEC Depository Libraries

Some general problems concerning the error due to pile-up effects and the method for diminishing it are discussed. The methods of determining pile-up effects and the devices used in such cases (pile-up inspectors) are considered. It is shown that inspectors investigating time intervals between two pulses offer good possibilities. The inspectors are classified and their specifications and performance are considered. It is shown that for the spectrometric system with pulse shaping in RC-filters the spectrometer inhibiting time with the inspector should be in logarithmic dependence upon the analyzing signal amplitude. Author (NSA)

N70-33699# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
THERMAL ANNEALING BEHAVIOUR OF RADIORHENIUM RECOILS FORMED BY HIGH ENERGY PROTON IRRADIATION OF SODIUM HEXACHLORIDATE
E. Ianovici and N. Zaitseva 1970 16 p refs
(JINR-E6-4916) Avail: AEC Depository Libraries

The thermal annealing behavior of radiorhenium recoils formed by irradiation of anhydrous sodium hexachloroiridate with 660-MeV protons was studied. The influence of irradiation-induced defects and inherent crystal defects on the subsequent thermal annealing of radiorhenium recoils is described. The activation energy of the annealing process is calculated. Author (NSA)

N70-33700# Eidgenossische Technische Hochschule, Zurich (Switzerland).
SPHERICAL FUNCTION SOLUTION OF THE NEUTRON TRANSPORT EQUATION FOR A THREE DIMENSIONAL CYLINDRICAL SYSTEM [KUGELFUNKTIONENLOESUNG DER NEUTRONENTRANSPORTGLEICHUNG FUER EIN DREIDIMENSIONALES ZYLINDRISCHES SYSTEM]
Claude Maeder (Ph.D. Thesis) 1968 54 p refs In GERMAN
(NP-18028; DISS-4120) Avail: AEC Depository Libraries

For a cylindrical system of finite height, the monoenergetic stationary equation for neutron flux is solved. At large distances from the symmetry axis, the scalar flux is determined by a diffusion equation. Close to the axis, the neutron flux is treated by Fourier analysis. Characteristics of parameters are analyzed especially for high N-values in P sub N approximation. The theory, applicable to calculating the scalar flux in reactors, could be adapted with only minor modifications to exponential assemblies. Author (NSA)

N70-33701# European Organization for Nuclear Research, Geneva (Switzerland).
DETERMINATION OF THE K PION ELASTIC CROSS SECTION BY CHEW-LOW EXTRAPOLATION [DETERMINATION DE LA SECTION EFFICACE ELASTIQUE K PION PAR EXTRAPOLATION DE CHEW ET LOW]
Denis Linglin (Ph.D. Thesis) 27 Nov. 1969 158 p
(NP-18127) Avail: AEC Depository Libraries

This review of the determination of the kaon + pion elastic cross sections by the Chew - Low extrapolation covers the theoretical explanation, statistical methods of analysis, the results, and a comparative study of various actual methods of extrapolation. NSA

N70-33702# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
THE Lu-170 YIELDS YB-170 DECAY
N. Bonch-Osmolovskaya, Kh. Ballund, A. Zglinskii, A. Plochocki, and Z. Prebisz 1969 41 p refs In RUSSIAN
(JINR-P-6-4773) Avail: AEC Depository Libraries

The Lu-170 yields Yb-170 decay was investigated by measuring the single gamma-spectrum and by using the coincidence technique. Based on this, the decay scheme was constructed and analyzed. The experimental results are compared with theoretical calculations. Author (NSA)

N70-33703# Eidgenossische Technische Hochschule, Zurich (Switzerland). Laboratorium fuer Kernphysik.
A SOURCE OF POLARIZED HYDROGEN IONS FOR THE TANDEM ACCELERATOR OF THE ETH [EINE QUELLE POLARISIERTER WASSERSTOFFIONEN FUER DEN TANDEM-BESCHLEUNIGER DER ETH]
W. Gruebler, V. Koenig, and P. Marmier [1968] 10 p In GERMAN Presented at Profess. Comm. on Nucl. Phys., Bad Neuenahr, W. Germ., 6 Apr. 1968
(CONF-680461-2) Avail: AEC Depository Libraries

A source of polarized hydrogen ions, operating on the atomic beam principle, was constructed and its design and construction are described. As preparation for the sign reversal, the cross section for the formation of negative hydrogen ions in potassium vapor was measured in the energy range from 3 to 20 keV and the polarization of a negative deuteron beam was determined as a function of the magnetic field in the sign reversal region. The patterns of the two boundary fields from the crossed magnetic and electrical fields used to rotate the polarization direction were determined. The T(deuteron,neutron)He-4 reaction was used to test the rotation of the spin direction with satisfactory results. NSA

N70-33726# Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Centro di Calcolo.
COLLIMATION CORRECTIONS IN SMALL ANGLE SCATTERING OF NEUTRONS
M. Antonini (CNEN, Ispra), A. Daneri, and G. Toselli 15 Oct. 1969 31 p refs Submitted for publication
(RT/FIMA(69)5) Avail: CFSTI

A numerical technique is developed for correcting experimental data of small angle diffuse scattering of neutrons for the effect of

instrumental resolution in the static approximation. The unfolding method does not require any particular a priori theoretical prediction on the form of the differential cross section while the resolution is assumed to be the product of two independent Gaussian functions representing the effect of the finite angular divergencies of the incident and scattered beams in the scattering plane (horizontal collimation) and in the normal plane (vertical collimation). The validity of the procedure is tested under various typical experimental conditions and the results are discussed also in connection with random errors affecting the input data. Author

N70-33743# Uppsala Univ. (Sweden). Inst. of Physics.
ELECTRON BINDING ENERGIES IN PROMETHIUM
G. Malmsten, Oe. Nilsson, I. Thoren, and J.-E. Bergmark Apr. 1969 8 p refs
(UUIP-635) Avail: AEC Depository Libraries

L, M and N electron binding energies in Pm were determined by electron spectroscopy for chemical analysis. The Pm isotope used in the photoelectron measurements was Pm-147, which is Beta(-) active with a half-life of 2.6 years. The Pm activity was deposited (3 × 15 sq mm) onto an aluminum foil by the method of molecular plating, with acetone as the plating liquid. This procedure gives the Pm specimen in the form of a metal organic complex with several hydrogen, carbon, and oxygen atoms included. The photoelectrons were expelled by characteristic Al, Cu, or Mo x radiation and detected by an array of five side-slit channel electron multipliers. When studying the photoelectrons from the 4p, and 4d levels, Al K alpha sub 1,2 was used for excitation. The 3s, 3p, 3d, 4s and 4p levels were studied with Cu K alpha sub 1,2 radiation. Each of the Cu K alpha lines has a width of approximately 2 eV and an energy of approximately 8 keV, giving somewhat less precision in the energy determination than with the Al radiation. Author (NSA)

N70-33758# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
ON THE KINETIC ENERGY VARIATION OF THE FRAGMENTS OF U 235 FISSION BY 0.15 TO 1.68 MeV NEUTRONS
E. Dermendzhiev, N. Kashukeev, Ts. Panteleev and Tyan San Hak 1969 11 p refs
(JINR-P3-4873) Avail: AEC Depository Libraries

The variation of the kinetic energy E sub k of fission fragments of U-235 was studied by the method of measuring the relative yield W of fission fragments from two U targets using an electrostatic generator. The dependence W(E sub n) was studied in the neutron energy range E sub n = 0.15 to 1.68 MeV. It was found that E sub n approximately 0.77 MeV and E sub n approximately 1 – 1.68 MeV mean of E sub n > mean of E sub k heat by approximately 0.4 MeV. Author (NSA)

N70-33759# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
DECAY OF Yb-167
A. A. Abdurazakov, R. Arlt, L. Funke (Zentralinst. fuer Kernforsch., Dresden), K. Gromov, A. F. Novgorodov et al 1969 22 p refs
(JINR-E-6-4782) Avail: AEC Depository Libraries

The level scheme of the deformed nucleus Tm-167 was investigated in the decay of Yb-167 using germanium detectors and a single gamma ray spectra and prompt and delayed gamma-gamma-coincidences were measured. About 45 new transitions were observed. Most of them were introduced into a level scheme of Tm-167 containing 13 new levels. In the low-energy region besides the rotational bands 1/2 positive (411), 7/2 positive (404) and 7/2 negative (523) the 5/2 and 3/2 members of the 1/2 negative (541) band could be identified. Possibilities of interpretation of the high-lying levels are discussed based on the microscopic model. Author (NSA)

N70-33760# Uppsala Univ. (Sweden). Inst. of Physics.
ESCA STUDIES OF OUTER LEVELS IN RARE EARTH ATOMS
Oe. Nilsson, J.-E. Bergmark and I. Thoren Mar. 1969 11 p refs
(UUIP-626) Avail: AEC Depository Libraries

Determinations of binding energies in rare earth elements are presented. The 4s, 4p, and 4d levels and the valence band structure were considered. Considerable deviations between the present experimental values and earlier tabulated binding energies were obtained. Author (NSA)

N70-33764# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
LOSS OF COHERENCY OF GAMMA PARTICLES IN A NiBi ALLOY
P. K. Rastogi 15 Apr. 1970 7 p refs
(Contract AT(04-3)-822)
(CALT-822-3) Avail: CFSTI

The coarsening of Ni3Si (gamma') precipitate in a binary Ni-6.5 wt.% Si was studied. It was found that the Si content does not vary linearly with the inverse of the cube root of the time. A sudden change in Si concentration in the matrix was observed in specimens aged at 775 C, and transmission electron microscopy was performed on specimens aged for different times. Mechanisms for the loss of coherency of the growing particles are discussed. It is felt from theoretical and experimental considerations that the plausible mechanism is through the supply of dislocations from the matrix in the gamma'-matrix interfaces by a climb process. N.E.N.

N70-33774# Joint Institute for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
STUDY OF THE PROPERTIES OF Cs NEUTRON-DEFICIENT NUCLEI. PART 4: ISOMER Cs-122m SUB 2
W. Neubert, Ch. Droste, S. Chojnacki, T. Morek, E. Levitovich et al 1969 10 p refs In RUSSIAN
(JINR-P6-4871-Pt-4) Avail: AEC Depository Libraries

The new isomer Cs-122m sub 2 with a half-life T sub 1/2 = 4.0 + 0.6 min was produced in reactions In-113(C-12, 3n) Cs-122 and Ag-109(O-16, 3n)Cs-122. In the beta(+)-decay of this isomer the levels of the quasi-rotational band in the nucleus Xe-122 are populated up to the 6(+) level. A possibility for the interpretation of the experimental results with the help of the existence of negative deformation is discussed. Author (NSA)

N70-33780# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
RECORDING CHARGED PARTICLE TRACKS IN THE ALKALI-HALIDE CRYSTALS
B. M. Golovin, V. I. Nikanorov, and A. F. Pisarev
(JINR-P13-4848) Avail: AEC Depository Libraries

For the detection of charged particles in the alkali-halide crystals it is suggested to excite and then to detect the luminescence of F-centers, produced by particles along their tracks. Author (NSA)

N70-33814# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
ON EQUIVALENT REGULARIZATIONS OF THE SCATTERING PROBLEM ON STRONGLY SINGULAR POTENTIALS
A. A. Arsenev 1970 13 p refs In RUSSIAN
(JINR-P5-4928)

A new method is suggested for reducing the problem of scattering on the singular potential to the Fredholm equation with a non-singular kernel. It is proved that the Laplace transformations of any function micron(Beta) from a rather wide group can be used as a regularizing function and the solution of the problem is a smooth function beyond the singular potential points. Author (NSA)

N70-33818*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTIC AND INELASTIC SCATTERING OF 18-MeV PROTONS ON Ne 20
R. F. Leonard, N. Baron, W. M. Stewart, and J. H. Jett (Colorado Univ.) 1969 10 p refs Presented at Am. Phys. Soc., Boulder, Colo., 30 Oct. - 1 Nov. 1969
(NASA-TM-X-52708) Avail: CFSTI CSCL 20H

Differential cross section measurements are reported for the scattering of 18 MeV polarized protons from neon-20. Cross section data are used to interpret known polarization data and to calculate the microscopic form factors that describe elastic and inelastic scattering. Angular distributions of all the states measured are shown; fits to the elastic scattering and polarization were carried out using optical model programs. G.G.

N70-33823# Lund Univ. (Sweden). Dept. of Physics.
QUALITATIVE MODEL OF HIGH-ENERGY PHOTOFISSION IN HEAVY ELEMENTS
Bent Schroeder and Bengt Forkman Oct. 1969 17 p refs
(LUNP-6906) Avail: AEC Depository Libraries

A qualitative model was worked out to describe the de-excitation of heavy nuclei after absorption of photons. Pion effects and fission parameters were studied. The resemblance with proton-induced fission failed to explain the great amount of asymmetric fission in the photon case. Heavy nuclei, however, were expected to de-excite independently of the way in which the excitation was achieved. Another unexplained observation was that the resonances in the fission cross sections occured about 75 MeV higher than the resonances in the cross sections for photoproduction of pions on free nucleons. These observations became the basis of derivations of a qualitative model to investigate the de-excitation scheme of high-energy photofission. Author (NSA)

N70-33824 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
INSTITUTE FOR NUCLEAR RESEARCH IN BERLIN Annual Report, 1969
May 1970 314 p refs In GERMAN
(HMI-B-91) Copyright. Avail: Issuing Activity

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N70-33827 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
REPORT OF THE NUCLEAR PHYSICS SECTION, EXPERIMENTAL DIVISION [BERICHT DES SEKTORS KERNPHYSIK, EXPERIMENTELLE ABTEILUNG]
In its Ann. Rept. 1969 May 1970 74 p refs In GERMAN (See N70-33824 18-24)
(BP-11-Pt-1) Copyright. Avail: Issuing Activity

Reported are experimental studies on nuclear isospin, scattering angle, stripping reaction, and nucleus structure in deuteron-neutron and proton-neutron reactions. Neutron-proton coincidence spectra are used to analyze several He(3) induced reactions for transfer and scattering angles. Also described are experiments with polarized neutrons, the optical determination of the nuclear potential, as well as nuclear physics experiments with semiconductor materials and gamma activation effects. Transl. by G.G.

N70-33828 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
REPORT OF THE NUCLEAR PHYSICS SECTION, THEORETICAL DIVISION [BERICHT DES SEKTORS KERNPHYSIK, THEORETISCHE ABTEILUNG]
In its Ann. Rept. 1969 May 1970 43 p refs In GERMAN
(BP-11-Pt-2) Copyright. Avail: Issuing Activity

Theoretical work centered on elastic scattering of alpha particles and its anomalies, effective particle-hole exchange reactions and isotopic phase transmissions, as well as on the formation and evaluation of theoretical nuclear reaction models. Emphasis is placed on hardware and software configurations for data processing systems applicable to nuclear structural analyses. Transl. by G.G.

N70-33866*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRON SCATTERING FROM LIGHT DEFORMED NUCLEI
Richard C. Braley and William F. Ford 1969 15 p refs Presented at Am. Phys. Soc. Meeting, Los Angeles, 29-31 Dec. 1969
(NASA-TM-X-52741; E-5476) Avail: CFSTI CSCL 20H

The elastic scattering of high-energy electrons from several 2s-1d shell nuclei is studied. The method used is based on the solution of the Dirac equation in the Glauber approximation. The initial and final states of the s-d shell nuclei are obtained by projecting states of good angular momentum from intrinsic Hartree-Fock states. The results are compared with Born approximation and with experiment. Author

N70-33887# Rome Univ. (Italy). Istituto di Fisica.
COMMENTS ON OMEGA-LIKE REGGE POLE EXCHANGE IN K-N SCATTERING
M. Lusignoli, R. Odorico, M. Restignoli, and G. Violini 11 Jul. 1969 15 p refs Its Nota Interna 232
(Contract F61052-67-C-0084)
(AD-705553; AFOSR-70-1238TR) Avail: CFSTI CSCL 20/8

It is shown that the evidence for the presence of a large omega absorptive correction in the B sup(-) amplitude at small values of t is affected by large uncertainties. Author (TAB)

N70-33895# Rome Univ. (Italy). Istituto di Fisica.
REMARKS ON THE CONNECTIONS BETWEEN THE HIGH ENERGY BEHAVIOUR OF RESONANCES AND UNITARITY
M. L. Paciello, L. Sertorio, and B. Taglienti 22 Jul. 1969 29 p refs Its Nota Interna 233
(Contract F61052-67-C-0084)
(AD-705550; AFOSR-70-1235TR) Avail: CFSTI CSCL 20/8

An attempt is made, with the aid of a model, of connecting the existence of infinite resonances with increasing mass to the Regge asymptotic behavior, via inelastic unitarity. This process might be considered as a reggeization threshold by threshold, with a simplified analytic structure which preserves crossing symmetry by sight. This last point is somewhat reminiscent of Veneziano. Author (TAB)

N70-33898# Rome Univ. (Italy). Istituto di Fisica.
FURTHER REMARKS ON THE HIGH ENERGY BEHAVIOUR OF RESONANCE POLES IN THE COMPLEX PLANE
M. L. Paciello, L. Sertorio, and B. Taglienti 12 Jan. 1970 32 p refs Its Nota Interna 250
(Contract F61052-67-C-0084)
(AD-705548; AFOSR-70-1233TR) Avail: CFSTI CSCL 20/8

By use of a model unitarity dynamical scheme, various possible energy behaviours of the resonance widths at high energy are analyzed. Correspondingly Re alpha(s) is calculated. Moreover in the model it is also found that a linear trajectory may only result in the limit of vanishing pion mass. Author (TAB)

N70-33897# Rome Univ. (Italy). Istituto di Fisica.
DO K MESONS VIOLATE THE POMERANCHUK THEOREM?
M. Restignoli and G. Violini 16 Feb. 1970 12 p refs Its Nota Interna 257
(Contract F61052-67-C-0084)
(AD-705547; AFOSR-70-1232TR) Avail: CFSTI CSCL 20/8

Recent positive Kaon-nucleon total cross section data are examined in the framework of the Regge pole model and the effect of possible systematic errors is investigated. No evidence is found for a violation of the Pomeranchuk theorem. Author (TAB)

N70-33899# Rome Univ. (Italy). Istituto di Fisica.
ON THE ORIGIN OF THE WEAK INTERACTION ANGLE 2
N. Cabibbo and L. Maiani 19 Jun. 1969 9 p refs Its Nota Interna 228
(Contract F61052-67-C-0084)
(AD-705546; AFOSR-70-1231TR) Avail: CFSTI CSCL 20/8

The paper presents a theory of the origin of the weak interaction angle, based on a self-consistency condition linking weak, strong and electromagnetic symmetry breaking effects. TAB

N70-33900# Rome Univ. (Italy). Istituto di Fisica.
GENERATING FUNCTIONALS, WARD IDENTITIES AND SCALAR MESONS
G. Parisi and M. Testa 27 Sep. 1969 16 p refs Its Nota Interna 242
(Contract F61052-67-C-0084)
(AD-705549; AFOSR-70-1234TR) Avail: CFSTI CSCL 20/8

The paper presents a general and concise treatment of Ward identities in current algebra with broken symmetry. An application is also presented to the mass spectrum and leptonic decay constants of the scalar and pseudoscalar mesons. Author (TAB)

N70-33901# Rome Univ. (Italy). Istituto di Fisica.
WEAK INTERACTION AND THE BREAKING OF HADRON SYMMETRIES
N. Cabibbo and L. Maiani 20 Jan. 1970 57 p refs
(Contract F61052-67-C-0084)
(AD-705552; AFOSR-70-1237TR) Avail: CFSTI CSCL 20/8

A recent paper (AD-705 546) proposed a dynamical relation among weak, strong and electromagnetic interactions, on the basis of a self-consistency condition which requires that the description of hadron physics remains unchanged by the effect of leading weak corrections and electromagnetic tadpole effects. The main results of the approach were a relation between the weak interaction angle (theta) and the symmetry breaking parameters, and the appearance of a non electromagnetic breaking of isotopic spin. The present paper presents a review of the whole theory putting a particular emphasis on those aspects which do not require explicitly the use of the self-consistency condition. TAB

N70-33903# Joint Inst. for Nuclear Research, Dubna (USSR).
EFFECT OF ULTRASOUND ON FORMATION OF IONIZING-PARTICLE TRACKS IN A LIQUID-HYDROGEN BUBBLE CHAMBER
V. A. Akulichev et al Jan. 1970 15 p refs Transl. into ENGLISH from o Vlyanii Ul Trazuuka Na Formirovanie Trekov Ionyziruyushchikh Chastits v Zhidkovodorodnoi Puzyr Kovoi Kamere (USSR), 1969 p 1-15
(SLAC-Trans-110; JINR-P13-4702) Avail: CFSTI

The effect of ultrasound on the formation of ionizing particle tracks in liquid-hydrogen bubble chamber is investigated experimentally. Design features and characteristic regimes of acoustic systems leading to a considerable effect of ultrasound on the increase of bubbles, which form tracks, are described. Author (NSA)

N70-33906# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE OPTICAL POTENTIAL FOR HIGH-ENERGY ELECTRON SCATTERING
I. Zh. Petkov 1969 8 p refs In RUSSIAN
(JINR-P4-4833) Avail: AEC Depository Libraries

The amplitude of the elastic scattering of electrons by nuclei is considered taking into account the effective monopole nuclear excitation. In a high-energy approximation a formula for a corresponding optical potential is deduced, which is a complicated even function of atomic number. Author (NSA)

N70-33923# Rome Univ. (Italy). Istituto di Fisica.
SU(3) TIMES SU(3) BREAKING AND THE MESON SYSTEM
A. K. Mohanti 10 Jun. 1970 19 p refs Its Nota Interna 223
(Contract F61052-67-C-0084)
(AD-705551; AFOSR-70-1236TR) Avail: CFSTI CSCL 20/8

The paper discusses a chiral Lagrangian model of spin 0 and spin 1 mesons transforming linearly under SU(3) X SU(3) broken in a way to preserve field-current identity, SU(3) invariance of Schwinger terms, and PCAC at SU(2) level and determines F sub k/(F sub pi)(f sub + (0)) with reasonable agreement with experiment. Author (TAB)

N70-33954*# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
RESEARCH INTO ADVANCED CONCEPTS OF MICROWAVE POWER AMPLIFICATION AND GENERATION UTILIZING LINEAR BEAM DEVICES Semiannual Status Report
P. R. Mc Isaac Jun. 1970 28 p refs
(Grant NGL-33-010-047)
(NASA-CR-109870) Avail: CFSTI CSCL 20H

Work during the past six months on some aspects of symmetry analysis applied to the interaction between electron beams and electromagnetic fields is summarized. Symmetry analysis is combined with coupled mode theory to explore the space charge waves and their associated phase constants for a coupled system of symmetrically located, parallel, electron beams. Both confined flow and Brillouin focused electron beams are considered. Author

N70-34033# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STEP TOWARD THE UNDERSTANDING OF ANTIMATTER
A. Logunov 8 Apr. 1970 9 p Transl. into ENGLISH from Pravda (Moscow), 14 Feb. 1970 p 3
(Contract F33657-70-C-0020)
(AD-705239; FTD-HT-23-217-70) Avail: CFSTI CSCL 20/8

The article briefly describes an experiment aimed at finding the antinuclei of the helium-3 isotope. The technique employed involved the acceleration of primary protons to an energy level of 70 Bev. TAB

N70-34133# Systems Science and Software, La Jolla, Calif.
MODIFICATIONS AND APPLICATIONS OF THE VERA SYSTEM OF CODES. VOLUME 1: MODIFICATIONS OF THE CODES Final Report
J. T. Palmer, B. E. Freeman, and J. H. Schlably Dec. 1969 177 p refs
(Contract DASA01-69-C-0078)
(AD-705513; DOC-69-256; Rept-3SCR-174; DASA-2420-1) Avail: CFSTI CSCL 20/8

The document describes modifications to the VERA (Variable Eddington Radiation Approximation) code and discusses the

Compton scattering treatments used in the VERA and TRAN codes. The progress made in the development of the IMTRAN (implicit transport) code is also reported. The VERA auxiliary codes SNPSHT and PIPES are documented and a detailed users guide provided. Finally, two problems investigating various aspects of nonequilibrium phenomena are discussed. Author (TAB)

N70-34136# Oak Ridge National Lab., Tenn.
A MONOENERGETIC 6130 KeV GAMMA-RAY SOURCE FOR DETECTOR CALIBRATION
J. K. Dickens and R. D. Baybarz 15 Apr. 1970 9 p refs Submitted for publication Sponsored in part by AEC and DASA
(AD-705510; ORNL-TM-2958) Avail: CFSTI CSCL 18/4

A monoenergetic 6130-keV gamma-ray source based upon the reaction 13C(alpha, n)16O has been fabricated using 244Cm as the alpha source. Author (TAB)

N70-34307# Oak Ridge National Lab., Tenn. Neutron Physics Div.
CALCULATED ACTIVATION OF COPPER AND IRON BY 3-GeV PROTONS
T. W. Armstrong and J. Barish (Union Carbide Corp., Oak Ridge, Tenn.) 16 Feb. 1970 13 p refs Submitted for publication
(PB-190183; ORNL-TM-2902) Avail: CFSTI CSCL 18H

An estimate of the residual photon dose rate and the neutron leakage induced in an accelerator magnet by a beam of 3-GeV protons is computed. The magnet is approximated as an infinite cylinder of copper surrounded by a layer of iron, with the proton beam located on the cylinder axis. Monte Carlo methods are used to determine the development of the nucleon-meson cascade, the residual nuclei production and the photon transport. Author (USGRDR)

N70-34331# Rensselaer Polytechnic Inst., Troy, N.Y.
DECAY PROPERTIES OF NEUTRON EXCESS ISOTOPES Technical Progress Report, 1 Jan. – 31 Dec. 1969
I. L. Preiss and H. M. Clark Jan. 1970 9 p refs
(Contract AT(30-1)-3948)
(RPI-3948-2) Avail: CFSTI

Research on the decay properties of neutron excess isotopes at Rensselaer Polytechnic Institute during 1969 is described. The studies covered photonuclear reactions of V-51, decays of samarium isotopes, photonuclear reactions of lutetium, and several other projects on neutron-deficient nuclei. NSA

N70-34340# Pittsburg Univ., Pa. Dept. of Physics.
INDEFINITE METRIC AND STATIONARY EXTERNAL INTERACTIONS OF QUANTIZED FIELDS
Jorge Andre Swieca (Sao Paolo Univ.) and Bert Schroer Mar. 1970 19 p refs
(Contract AT(30-1)-3829)
(NYO-3829-48) Avail: CFSTI

The necessary modifications of the state space for quantum fields interacting with strong stationary external fields are discussed. In addition to the introduction of indefinite metric the possibility of having positive metric without a vacuum state is discussed. Author (NSA)

N70-34341# Texas A&M Univ., College Station. Dept. of Chemistry.
ON LINE ALPHA AND PROTON DECAY SPECTROMETRY Annual Progress Report, 1969
Ronald D. Macfarlane and David F. Torgerson 15 Jan. 1970 20 p refs
(Contract AT(40-1)-3820)
(ORO-3820-3) Avail: CFSTI

The progress in nuclear research by the Texas A & M Dept. of Chemistry during 1969 is summarized. The studies included systems development, beta-delayed alpha and proton decay, alpha decay near the N 126 closed shell, heavy-ion reactions near the N = 126 closed shell, alpha decay of thermal neutron capture states, and a search for a heavy alpha-emitting component of cosmic rays. NSA

N70-34343# Notre Dame Univ., Ind. Dept. of Physics.
OFF MASS SHELL VENEZIANO AMPLITUDES FOR GAMMA PION YIELDS GAMMA GAMMA AND ETA MESON YIELDS PION PION GAMMA
K. C. Gupta [1970] 10 p refs
(Contract AT(11-1)-427)
(COO-427-98) Avail: CFSTI

Gamma-3 pion coupling constant and eta meson yields pion pion gamma decay are studied under the assumptions of current-field identity and an off-mass-shell extrapolation of Veneziano amplitudes for the respective strong processes. Author (NSA)

N70-34354# Oak Ridge National Lab., Tenn.
THERMAL CONDUCTIVITY OF Cm2O3
E. E. Ketchen Apr. 1970 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2915) Avail: CFSTI

The thermal conductivity of Cm(244)2O3 has been measured at 500 to 1100 C by an absolute method in which an accurately known quantity of heat which is produced by alpha decay of Cm-244 flows longitudinally through the sample. Author (NSA)

N70-34366# Oak Ridge National Lab., Tenn.
DESIGN CONSIDERATIONS FOR AN ORELA TARGET USING TANTALUM FOLLOWED BY BERYLLIUM
R. S. Booth 31 Mar. 1970 57 p refs
(ORNL-TM-2925) Avail: CFSTI

The nuclear calculations associated with the design of a neutron source composed of tantalum followed by beryllium for the Oak Ridge Electron Linear Accelerator (ORELA) are presented. Electrons incident on the tantalum converter produce a narrow beam of intense photons which then generate neutrons in the beryllium. The primary considerations associated with this analysis are the size of the beryllium block and the distance between the beryllium block and the tantalum converter. Monte Carlo calculations of the neutron interactions in the beryllium are used to predict the expected neutron intensity at two flight stations as a function of position in the source plane and time-of-arrival (energy) of the neutron flux. The time spread, caused by migration in the beryllium, of a monoenergetic neutron pulse energy is calculated for the same flight stations. The final predicted neutron intensity is compared with a measured neutron intensity from a target system similar to the one designed here. Author (NSA)

N70-34382# Turin Univ. (Italy). Inst. of Theoretical Physics.
NEED OF A I 3/2, J(p) = 1/2+ PION-NUCLEON RESONANCE FOR THE SATURATION OF SUPERCONVERGENCELIKE SUM RULES Interim Scientific Report
R. D'Auria 11 Jun. 1969 5 p refs Submitted for publication
(Grant AF-EOAR-68-0015)
(AD-705328; AFOSR-70-1077TR) Avail: CFSTI CSCL 20/8

Recently it has been shown how one can obtain superconvergencelike sum rules by the combined use of current algebra and field commutators; i.e. algebraic relations between vertices and masses of different particles and resonances in the framework of an isobaric model. The letter makes some comments about the problem of saturation of such sum rules. TAB

N70-34403# Colorado Univ., Boulder. Dept. of Physics.
INSTRUCTIONS FOR THE USE OF DWUCK: A DISTORTED WAVE BORN APPROXIMATION PROGRAM

P. D. Kunz [1970] 20 p refs
(COO-535-606) Avail: CFSTI

Instructions for the use of the distorted-wave Born approximation program DWUCK are presented including the microscopic interaction and two-nucleon transfer. NSA

N70-34404# Texas Univ., Austin. Center for Particle Theory.
LOW t THEOREMS FOR CHARGED PION PHOTOPRODUCTION
J. A. Campbell, Robert Beck Clark, and D. Horn (Calif. Inst. of Tech.) Mar. 1970 27 p refs Sponsored in part by NSF Prepared in Cooperation with Calif. Inst. of Tech., Pasadena
(Contract AT(11-1)-68)
(CALT-68-245) Avail: CFSTI

Low t theorems for charged pion photoproduction are proved on the basis of gauge invariance restrictions. They can be simply formulated by means of the minimal gauge invariant extension of pion exchange (MPE). It is shown that whereas MPE leads in proton nucleon gives plus or minus pi or nucleon only to weak restrictions near the forward direction, it does actually account for all the structure observed in neutron proton gives negative pion negative pion positive positive delta hyperon in this t domain. Results for these reactions as well as the other charge modes of proton nucleon gives positive negative pion delta hyperon are discussed and compared with experiment. Author

N70-34406# Addis Translations International, Woodside, Calif.
THE 'SQUIRREL-CAGE' SYSTEM OF FOCUSSING AN ELECTRON RING IN A COLLECTIVE LINEAR ION ACCELERATOR [FOKUSIROVKA ELEKTRONNOGO KOLTSA V KOLLEKTIVNOM LINEINOM USKORITELE IONOV SISTEM I TIPA 'BELICHE KOLECO']
G. V. Dolbilov et al Feb. 1970 9 p refs Transl. into ENGLISH of Russian Preprint JINR-P9-4737 Radiation Lab.
(UCRL-Trans-1408; Conf-690811-16) Avail: CFSTI

An axial focusing of an electron ring by means of image forces has been considered for the case when the screen is a system of the squirrel cage type. A possibility for the practical use of this system in a collective ion accelerator is discussed. Author (NSA)

N70-34444*# Translation Consultants, Ltd., Arlington, Va.
SOME SUGGESTIONS CONCERNING OPTICAL PRODUCTION AND OPTICAL DETECTION OF A POPULATION INEQUALITY OF THE LEVELS OF SPATIAL QUANTIFICATION OF ATOMS. APPLICATION TO THE STERN AND GERLACH EXPERIMENT AND TO MAGNETIC RESONANCE [QUELQUES SUGGESTIONS CONCERNANT LA PRODUCTION OPTIQUE ET LA DETECTION OPTIQUE D'UNE INEGALITE DE POPULATION DES NIVEAUX DE QUANTIFICATION SPATIALE DES ATOMES. APPLICATION A L'EXPERIENCE DE STERN ET GERLACH ET A LA RESONANCE MAGNETIQUE]
A. Kastler Washington NASA Aug. 1970 25 p refs Transl. into ENGLISH from J. Phys. Radium (Paris), v. 11, no. 6, Jun. 1950 p 255-265
(Contract NASw-2038)
(NASA-TT-F-13176) Avail: CFSTI CSCL 20H

Unequal population of the various m sublevels which characterize the spatial or magnetic quantification of the basic level is obtained by lighting the atoms of a gas or an atomic pencil with radiations of guided resonance. Population dissymmetry of the m sublevels of the natural state may be detected optically by examining the intensity and the polarization of the optic resonance radiations. Experiments on magnetic resonance show that transitions induced by the magnetic field oscillating with radio frequency tend to destroy the population inequalities of the m levels, and the possibility of lumino-caloric and lumino-frigoric effects are studied. Author

N70-34498# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
PHASE-SPACE VOLUME OF ANGULAR CORRELATIONS FOR THE REACTION A + B YIELD C + D + E FOR THE CASE OF ARBITRARY PARTICLE MASSES
V. K. Suslenko 1970 6 p In RUSSIAN
(JINR-P2-4914) Avail: CFSTI

The phase-space relativistic expressions for angular correlations of particles in the final state of the reaction A + B yields C + D + E were derived for the case of arbitrary masses of particles involved in the given reaction. Author (NSA)

N70-34517# California Univ., Berkeley. Lawrence Radiation Lab.
A METHOD FOR MAPPING THE SPATIAL DISTRIBUTION OF STOPPING PION(-) MESONS IN TISSUE
A. J. Miller, M. R. Raju, A. Rindi, V. Perez-Mendez, and J. Sperinde 30 Oct. 1969 6 p refs Presented at the Meeting on Nucl. Phys. Div., Am. Phys. Soc., Boulder, Colo., 20 Oct.-1 Nov. 1969
(Contract W-7405-eng-48)
(UCRL-19376; CONF-691019-2) Avail: CFSTI

The use of capture gamma rays from negative pion mesons stopping in tissue is described for the purpose of mapping the stopping region. Gamma rays of energy greater than 15 MeV were detected, and the measured distributions are shown. NSA

N70-34536*# Wisconsin Univ., Madison. Dept. of Chemistry.
RATE CONSTANT FOR DEUTERIUM ATOM RECOMBINATION CALCULATED BY THE ORBITING RESONANCE THEORY
R. E. Roberts (Indiana Univ.) and R. B. Bernstein 25 May 1970 9 p refs
(Grants NGL-50-002-001; NSF GP-7409)
(NASA-CR-109946; WIS-TCI-388) Avail: CFSTI CSCL 20H

The resonance theory of termolecular recombination kinetics is applied to the reaction D + D + D2 yields 2D2. The isotope effect, i.e., the rate of deuterium recombination compared to that of hydrogen, is computed over the range 50 - 300 K. From 100 deg to room temperature the ratio for D/H is 0.7 sub 1 (+ or - 0.02), in agreement with the experiments value of Amdur and a very recent determination by Kaufman, Ham and Trainar. Author

N70-34547# Los Alamos Scientific Lab., N.Mex.
INTERPLANAR SPACING TABLES FOR Mn-K ALPHA 1 RADIATION
Josephine E. Powers and Charles P. Kempter Aug. 1969 62 p refs
(Contract W-7405-eng-36)
(LA-4240) Avail: CFSTI

Tables of interplanar spacings are presented for Mn K alpha sub 1 radiation for the angles theta from 0 to 89.99 deg at intervals of 0.01 deg and for the angles 2 theta from 0 to 179.98 deg at intervals of 0.02 deg. The applicability of the manganese target in comparison with other X-ray targets for the precise determination of lattice parameters is discussed. Author (NSA)

N70-34548# Los Alamos Scientific Lab., N.Mex.
ATLAS OF GAMMA-RAY SPECTRA
J. P. Balagna and S. B. Helmick 31 Oct. 1969 94 p
(Contract W-7405-eng-36)
(LA-4312) Avail: CFSTI

Gamma-ray spectra produced with a germanium detector are shown. The radioactive species used are those produced by thermal-neutron activation of 70 chemical elements. Author (NSA)

N70-34561# Neve Physik, Vienna (Austria).
PHOTRON THEORY OF LIGHT AND MATTER [PHOTRONENTHEORIE DES LICHTES UND DER MATERIE]
K. Nowak [1969] 9 p refs In GERMAN
Avail: CFSTI

Developed is a phenomenological and arithmetic discrepancy-free classical explanation for events in atomic and radiation physics. A theoretical model is postulated that explains light as a motion of sub-atomic corpuscles whose sub-electric charges are connected with each other by accompanying waveforms. The calculated specific charge for these hypothetical photrons is about 2.5 times 10,000 of the specific electron discharge; this establishes that the carrier's sub-electric charge is much smaller than the electric elemental charge but much higher in relation to photron mass. Positive and negative photrons are also regarded as basic building materials of matter; in this context, the sub-electric charge is a property bound to the sub-matter. A new atomic model explains photronic light emission by the laws of elastic shock; correlation of shock electron velocity with the ratio of electron mass to light quanta mass delivers the correct light velocity. Thus, light velocity is a mechanical motion relative to the emitted atom which is constant because the mass of light quanta increases linear to the discharge energy. Transl. by G.G.

N70-34575# Joint Inst. for Nuclear Research, Dubna (USSR).
CHANNELS OF THE REACTION PION(-) PROTON YIELDS NEUTRON PION(+) PION(-) M-PION(0) AT pc = 4 GeV
V. G. Grishen 1969 18 p refs Transl. into ENGLISH from Russian report
(NP-tr-1877; JINR-P1-4412) Avail: AEC Depository Libraries

The reaction was studied using a 24-liter propane bubble chamber pion(-) meson momentum p = 4 GeV/c. A total of 150,000 pictures were scanned and 2,374 events were observed. The cross sections of channels in the reaction (1) are given and the momentum and angular distributions of pion(+)-mesons in c.m.s. are represented. Author (NSA)

N70-34577# Gulf General Atomic, San Diego, Calif.
NEUTRON SCATTERING KERNELS CALCULATIONS AT EPITHERMAL ENERGIES
G. M. Borgonovi 17 Mar. 1970 24 p refs
(Contract AT(04-3)-167)
(GA-9950) Avail: CFSTI

For some reactor spectra calculations, neutron scattering kernels extending up to epithermal energies of 3 to 5 eV are needed. The FLANGE and FLANGE 2 codes were modified to compute an approximate value of the scattering law for energy transfers larger than the maximum in the tabulated scattering law for thermal energies. The basic steps in the derivation of the short collision time approximation formula used in modifying the codes are summarized, and the differences between the FLANGE and FLANGE 2 codes are described. Examples of results obtained with the codes are given, and the performance of the two codes is compared. NSA

N70-34578# Pittsburgh Univ., Pa. Dept. of Physics.
HIGHER ORDER TERMS IN THE CURRENT-CURRENT THEORY OF WEAK INTERACTIONS
R. S. Willey and J. M. Tarter Feb. 1970 43 p refs
(Contract AT(30-1)-3829)
(NYO-3829-47) Avail: CFSTI

A study is made of the consequences of the hypothesis that, for some range of energies, the second order terms in the perturbation expansion of the Fermi theory are small but nonnegligible corrections to the first order terms, and responsible for reactions which violate first order selection rules. Matrix elements are computed through second order in the weak coupling constant G and subtraction constants which are necessary to render the matrix elements finite to this order are introduced. From this point of view a number of weak interaction problems are considered including the experimental parameters of muon-decay, the unviersality of the muon-decay coupling constant and the Fermi beta-decay coupling constant, K sub 13 decays, and delta S = delta Q and delta S = 2 semileptonic decays. Author (NSA)

N70-34613# Scientific Translation Service, Ann Arbor, Mich.
Argonne National Lab., Ill.
A STUDY OF THE LEVEL SCHEME OF Hf 178
P. T. Prokofev et al Mar. 1970 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Fiz. (Moscow), v. 33, no. 10, 1969 p 1655-1661 Prepared for Argonne Natl. Lab.
(ANL-Trans-815) Avail: CFSTI

The energy level scheme of hafnium-178 was studied using a beta-ray spectrograph. There were 70 transitions identified, 28 for the first time, in the energy region from 770 to 2000 keV. Multipole orders were assigned to certain high-energy gamma transitions and are shown. Also ratios of reduced probabilities and intensities of transitions from levels 22(+) and 23(+) to the levels of the rotational band of the ground state are given. A level scheme is proposed. The gamma and beta vibration bands and the rotational bands of two-quasiparticle states are discussed. NSA

N70-34615# California Inst. of Tech., Pasadena.
SYMMETRY VIOLATION IN HADRON PHYSICS
Murray Gell-Mann Aug. 1969 37 p refs
(Contract AT(11-1)-68)
(CALT-68-244) Avail: CFSTI

SU(3) × SU(3) symmetry, its violation by the strong interaction, and possible connections with weak and electromagnetic effects are studied. Also the breaking of scale invariance by the strong interaction and the possible relations between scale-invariance violation and SU(3) × SU(3) violation are considered. NSA

N70-34616# Illinois Univ., Urbana. Dept. of Physics.
[ELEMENTARY PARTICLE PHYSICS RESEARCH] Annual Progress Report
Apr. 1970 29 p refs
(Contract AT(11-1)-1195)
(COO-1195-183) Avail: CFSTI

Research on high-energy physics experiments at the University of Illinois for the year ending April 1970 is reported. Abstracts of both bubble and spark chamber experiments are given for research completed, in progress, and planned for the future. A list of publications is also included. NSA

N70-34617# Rochester Univ., N.Y.
COMMENTS CONCERNING THE EFFECTS OF KAON-PION MISIDENTIFICATION UPON THE DETERMINATION OF THE DECAY PROPERTIES OF THE Q
T. Ferbel, R. Holmes, P. Slattery, and B. Werner Apr. 1970 11 p refs
(Contract AT(30-1)-875)
(UR-875-304) Avail: CFSTI

An attempt is made to investigate some of the possible effects of kaon-pion ambiguities upon studies of the decay characteristics of the Q in positive negative kaon + proton yields positive negative Q + proton, positive negative Q yields positive negative kaon + positive pion + negative pion interactions. A total of 208 kaon-pion ambiguous events are examined in order to ascertain the extent of possible biases in a sample of positive Q data, and scatter plots are presented comparing the two acceptable kinematic hypotheses. NSA

N70-34638# Gulf General Atomic, Inc., San Diego, Calif.
INTEGRAL NEUTRON THERMALIZATION Annual Summary Report, 1 Oct. 1968 - 30 Sep. 1969
G. M. Borgonovi, D. H. Houston, J. M. Neill, and E. L. Slaggie 30 Oct. 1969 81 p refs
(Contract AT(04-3)-167)
(GA-9753) Avail: CFSTI

Research progress in integral neutron thermalization studies is reported. The studies included coherent neutron scattering by beryllium, formulation of a central force model for uranium carbide, coherent scattering by UO2 and UC, temperature dependence of phonon frequency distributions, crystal binding effects on Doppler broadening of neutron absorption resonances, and other miscellaneous activities. NSA

N70-34721# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
THERMODYNAMIC STUDIES ON HEAVY ELEMENTS AND STUDIES IN NUCLEAR CHEMISTRY Annual Report, Feb. 1969 - Jan. 1970
J. W. Cobble, ed. 1 Jan. 1970 14 p refs
(Contract (AT(11-1)-1716)
(COO-1716-8) Avail: CFSTI

Research progress is reported on: the chemically bound neutron; additional sources for chemically bound neutrons; ternary fission of Th; search for ternary fission in Au-197, Pi-209, and Pu-239 induced with He-4 ions; range of Mg-28 from ternary fission of U-238 with 35 MeV protons; heavy ion ternary fission studies; thermodynamic functions for Pu(3+) (aq); standard state entropies for the aqueous trivalent lanthanide and yttrium ions; and partial molal heat capacity of UO2 (2+) (aq). NSA

N70-34722# Los Alamos Scientific Lab., N.Mex.
TIME REVERSAL IN POLARIZATION PHENOMENA OF NUCLEAR INTERACTIONS
P. W. Keaton, Jr. Jan. 1970 44 p refs
(Contract W-7405-eng-36)
(LA-4373) Avail: CFSTI

The concept of time reversal invariance is reviewed along with some basic properties of the time reversal operator, T. Applications to specific nuclear physics problems are given which demonstrate methods of manipulating T in a calculation. Using the density matrix formalism, a relation is derived between polarization transfer (triple scattering) experiments that describe reactions and inverse reactions with initially polarized particles. The fundamental relations are illustrated by examples. Relativistic effects and photon polarizations are not discussed. Author (NSA)

N70-34727# Oak Ridge National Lab., Tenn.
SPACE AND FREQUENCY-DEPENDENT ENERGY SPECTRUM OF NEUTRON WAVES IN A MODERATING MEDIUM
R. S. Booth and W. A. Swansiger 22 Apr. 1970 27 p refs
(ORNL-TM-2950) Avail: CFSTI

A theoretical investigation was made of the effect of continuum energy mode contamination on thermal neutron wave experiments conducted with grqphite. The incentive for this work was that the cooling coefficient obtained experimentally is larger by a factor of two than that predicted by theory. The eigenfunction expansion method of analysis with use of the sophisticated scattering kernel SUMMIT resulted in a reconstruction of the energy spectrum of the neutron waves, with both frequency and distance from the source as parameters. This reconstructed flux was used to calculate the fraction of an experimental measurement that would be caused by the continuum energy modes. It is concluded that continuum energy mode contamination would introduce an error of < 5% in the experiment mentioned above, and, thus, it could not account for the factor of 2 discrepancy between the theoretical and experimental results. Author (NSA)

N70-34735# California Univ., Berkeley. Lawrence Radiation Lab.
STOPPING POWER, RANGE, AND TERMINAL IONIZATION OF ANY NUCLEUS WITH 0.01 TO 500 MeV/AMU IN ANY NONGASEOUS MATERIAL, INCLUDING NUCLEAR EFFECTS
Roger Wallace, Gerald M. Litton, and Palmer G. Steward 29 Apr. 1969 69 p refs Presented at the 2d Intern. Conf. on Accelerator Dosimetry and Experience, Stanford, Calif., 5-7 Nov. 1969
(Contract W-7405-eng-48)
(UCRL-19391; CONF-691101-17) Avail: CFSTI

Several methods are combined to provide the range, stopping power, and Bragg peak data for any heavy ion with energy lying between 0.01 and 500 MeV per amu when incident on any nongaseous stopping medium. A FORTRAN 4 program providing both numerical data and machine plots is available. Bethe's theory is used for all ions at high energy, and Bloch's theory is discussed. The particle ranges calculated by the method are pathlength ranges and do not include the effects of multiple scattering. Using the calculated range energy and energy loss data, a method is described to calculate Bragg curves, flux curves, and energy spectra. Energy loss from electronic and nuclear elastic collisions, nuclear attenuation, small-angle multiple scattering, straggling initial energy, and angular spreads of the beam are all taken into consideration. Contributions from secondary particles have been estimated. It is found that for a given range in a particular target, the peak-to-plateau dose ratio goes through a maximum as the atomic number of incident ions increases. Author (NSA)

N70-34759# Texas A&M Univ., College Station. Cyclotron Inst.
NUCLEAR SPECTROSCOPY Progress Report, 1 Jan. - 31 Dec. 1969
T. T. Sugihara and R. L. Watson 31 Dec. 1969 52 p refs
(Contract AT(40-1)-3921)
(ORO-3921-3) Avail: CFSTI

Decay scheme studies with emphasis on transitional nuclei in the region between spherical and those permanently deformed in their ground states are presented. The 8h and 21h isomers of Tb-154, and Tb-150 are studied, and a computer analysis of multiples in Ge(Li) spectra is presented. In-beam spectroscopic studies are included. F.O.S.

N70-34779# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
NUCLEAR MOMENT MEASUREMENTS USING HEAVY ION RECOIL TECHNIQUES
L. Grodzins 10 Dec. 1969 26 p refs Presented at the Intern. Conf. on Nucl. Reactions Induced by Heavy Ions, Heidelberg
(Contract AT(30-1)-2098)
(MIT-2098-601; Conf-690707-3) Avail: CFSTI

The uses of heavy ions to measure magnetic moments of nuclear excited states are discussed. Results and charts of the measurement of gyromagnetic ratios of the first 2+ states of even-even nuclei are presented. Brief descriptions of IMPAC, a technique for the study of the perturbation of angular correlations following the implantation of nuclei into ferromagnetic environments, and of hyperfine interactions on ions recoiling in a vacuum are given. Early attempts to measure quadrupole interactions of moderately short-lived nuclear states by spectroscopic techniques involving ion implantation into crystals are described. NSA

N70-34796*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE p-p AND p-t FINAL STATE INTERACTIONS IN THE REACTION He-3(d,tp)p
R. E. Warner (Oberlin Coll.), B. E. Corey (Oberlin Coll.), E. L. Petersen (Oberlin Coll.), R. W. Bercaw, and J. E. Poth (Miami Univ., Oxford, Ohio) Washington Aug. 1970 26 p refs
(NASA-TN-D-5927; E-5383) Avail: CFSTI CSCL 20H

Absolute coincidence cross sections were measured for the reaction He-3(d,tp)p at deuteron energy = 20.7 MeV. Deep minima were observed in the cross sections when the relative energy of either p + p or t + p was below approximately 20 keV. Predictions of the Watson-Migdal theory and of the PWBA and DWBA theories of Henley, Richards, and Yu gave good agreement with the shapes of the spectra near these minima, but the required normalization factors varied widely from one geometry to another. Decay of the 21.2-MeV He-4 state, but not the 20.0-MeV state, was observed. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-33407# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CORRECTION TERM OF LANDAU DAMPING DUE TO TRAPPED PARTICLES
Ryo Sugihara and Jun-Ichi Sakai Jun. 1970 10 p refs
(IPPJ-89) Avail: CFSTI

An approximate expression for the damping coefficient of an electron plasma wave with a finite amplitude is obtained. It is given in the form of linear and nonlinear Landau damping coefficients. The expression is valid for the case where tau is much less than the bouncing frequency of electrons trapped in a potential trough of the wave. Author

N70-33445# Institute of Nuclear Research, Warsaw (Poland).
THE TWO STREAM INSTABILITY AND ITS CLASSIFICATION INTO ABSOLUTE AND CONVECTIVE FOR HOT PLASMAS
E. Infeld and A. Skorupski 1969 21 p refs
(INR-P-1132) Avail: AEC Depository Libraries

The method is based on the criterion of Fainberg, Kurilko, and Shapiro. The basis of the analysis is the resonance distribution, but a modified resonance distribution, leading to better results, is also investigated. The stability limit, classification into absolute and convective instabilities, as well as asymptotic growth rates, are given for some chosen values of stream densities and temperatures, and arbitrary stream velocities. A method for finding the maximum temporal growth rates is also outlined. Author (NSA)

N70-33517# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF THE MASS DISTRIBUTION FROM THE EXHAUST OF A COAXIAL PLASMA ACCELERATOR
Robert Dale Strouse (M.S. Thesis) Jun. 1969 74 p refs
(AD-706028) Avail: CFSTI CSCL 20/9

Investigations were conducted on the mass distribution of the exhaust of a coaxial plasma accelerator in order to gain insight into the manner by which the fuel (gold) is ionized and accelerated. Tests were conducted using both annular sections of gold foil and single strands of gold wire. Both types of runs showed a non-uniform angular distribution with one or more well defined peaks. The similarity between the distributions leads to the probable conclusion that the foil, rather than undergoing uniform ionization around the annulus, is actually ionizing a discreet spokes about its periphery. Experiments conducted with gold foil involved varying the distance from the accelerator to the collector. A fairly uniform dispersion of gold plasma was observed as collector distance increased. Author (TAB)

N70-33526# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Conversione Diretta.
A DEVICE FOR THERMAL AND ELECTRICAL IONIZATION OF ALKALI VAPORS IN NOBLE GAS ATMOSPHERE, WITH ACCESSIBILITY FOR OPTICAL ELECTRICAL AND MICROWAVE DIAGNOSTICS
A. Boschi and N. Merzagora 17 Oct. 1969 28 p refs
(RT/FI(69)48) Avail: CFSTI

The device described here is designed to generate thermal ionization of an alkali vapor (cesium 0.2 ÷ 20 torr) in thermodynamic equilibrium within a steady atmosphere of nobel gas (helium 100 ÷ 1500 torr) contained inside an electrically insulating hot chamber (at 1000 ÷ 2000°K). This device is used to investigate the non-equilibrium ionization phenomena occurring there, in the presence of a diffused electrical discharge and an applied magnetic field. The chamber is accessible to optical (in the visible and near infrared) microwave (in the millimetric wavelength range) and electrical diagnostics. Author

N70-33547# Institute of Nuclear Research, Warsaw (Poland).
ELECTRICAL PARAMETERS IN THE FARADAY TYPE MHD GENERATOR WITH NONUNIFORM GAS PROPERTIES IN THE MAGNETIC FIELD DIRECTION
Z. Celinski 1969 76 p refs
(INR-1095) Avail: AEC Depository Libraries

The effects of gas velocity and temperature distributions in the direction of a magnetic field on the electrical parameters of the Faraday-type MHD generator are considered. As gas properties are varying along the z axis, circulating currents are flowing in the cross-sectional area of the channel due to the nonuniform distribution of the gas velocity. These currents induce the Hall circulating currents along the x axis. The ohmic losses due to the circulating currents are independent of the load factor. The maximum point of the efficiency curve versus load factor is shifted to the lower values of the generator loading. The weak Hall fields can be induced in the open circuit conditions of the generator due to the nonuniform distribution of the Hall parameter. A constant channel cross section, no-leakage currents in the walls, a constant magnetic field, as well as constant electrical and gasdynamical parameters along the channel, are assumed. It is also assumed that the distributions of the gas parameters are independent of the load factor. A numerical example is calculated. Author (NSA)

N70-33589# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THEORY OF ELECTRON IMPACT BROADENING IN PLASMAS
Akio Tsuji and Hajime Narumi Apr. 1970 20 p refs Submitted for publication
(IPPJ-90) Avail: CFSTI

A quantum-mechanically consistent formulation of the theory of electron impact broadening in plasmas is given by using the scattering matrices obtained from closed coupling procedure instead of the classical path approximation, where parameter of the impact radius, can be removed. Concrete calculations of neutral and ionized radiators are carried out for hydrogenic systems. Author

N70-33648# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
PRODUCTION AND FOCUSING OF A HIGH-POWER RELATIVISTIC ANNULAR ELECTRON BEAM
Moshe Friedman and Michael Ury Jan. 1970 14 p refs
(Contract N00014-67-A-0077-0003)
(AD-706040; LPS-36) Avail: CFSTI CSCL 20/9

A new electron beam injection gun has been developed to produce pulsed relativistic electron beams with a power of 10 to the 10th power watts. The annual - shaped beam propagates in a magnetic field with efficiencies approaching 100%, and its radius may be controlled by the magnetic field configuration. Typical results obtained with a 4-inch diameter cathode are reported. Author (TAB)

N70-33649# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
PASSAGE OF AN INTENSE RELATIVISTIC ELECTRON BEAM THROUGH A CUSPED MAGNETIC FIELD
Moshe Friedman Mar. 1970 15 p refs
(Contract N00014-67-A-007-0002)

(AD-706041; LPS-37) Avail: CFSTI CSCL 20/9

A high-intensity, high-current relativistic beam has been injected into a cusped magnetic field. Energy detected by a calorimeter has been used to determine that 10 to the 14th power electrons are passed through the cusp. Preliminary observations indicate that these electrons produce a cloud of relativistic electrons gyrating in a magnetic field having a small ratio of translational to rotational energies. Author (TAB)

N70-33672# Institute of Nuclear Research, Warsaw (Poland).
ELECTRICAL PARAMETERS IN THE FARADAY-TYPE MHD GENERATOR WITH NONUNIFORM GAS PROPERTIES IN THE ELECTRIC FIELD DIRECTION
Z. Celinski 1969 69 p refs
(INR-1096) Avail: AEC Depository Libraries

The effects of gas velocity and temperature distributions in the direction of an induced electrical field, on the electrical parameters of the Faraday-type MHD generator are considered. As gas properties are varying in the y direction, strong Hall currents are flowing in the x direction. These currents deteriorate the electrical performance of the generator; the A parameter which characterizes this deterioration is determined. The decrease of electrical terminal values may be strong especially is the case when the magnetic induction is high. The parameter A is proportional to B-2 and depends on the distribution functions of the gas conductivity and of the Hall parameter. The distributions of the electrical parameters in the y direction (current density, electrical potential, electrical field) become more non-uniform with the increasing of B. A constant channel cross section, no-leakage currents in the walls, a constant magnetic field, as well as constant electrical and gasdynamical parameters along the channel are assumed. It is also assumed that the distributions of the gas parameters are independent of the load factor. A numerical example is calculated. Author (NSA)

N70-33725# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SUPPRESSION OF DRIFT WAVE INSTABILITY BY RF ELECTRIC FIELD
Y. Nishida (Tohoku Univ., Sendai, Japan), M. Tanibayashi, and K. Ishii Jun. 1970 10 p refs
(IPPJ-91) Avail: CFSTI

The suppression of drift instabilities in a dc discharge plasma is observed by applying to the plasma a homogeneous rf electric field. Upon stabilization, the instability amplitude is reduced by more than a factor of 30 and, concomitantly, decrease of plasma loss across the magnetic field is observed. Author

N70-33740# Scientific Research Inst. of Electro-Physical Apparatus, Leningrad (USSR).
DIFFUSION IN EXPERIMENTS ON HIGH-FREQUENCY STABILIZED PLASMA
L. V. Dubovoi and V. F. Shanskii 1969 16 p refs In RUSSIAN
(NP-18145) Avail: AEC Depository Libraries

The diffusion coefficient of charged particles was measured in order to determine the high-frequency stabilization of the Kadomtsev – Nedospasov current-convective instabilities in electron – hole plasma in germanium semiconductors. The diffusion coefficient was obtained on the basis of the spatial distribution of particles in plasma, measured by the method of free-carrier absorption of He-Ne laser infrared emission. It is shown that the high-frequency stabilization results in reduction of the anomalous diffusion coefficient down to the magnitudes close to those measured in the case of steady-state plasma. Author (NSA)

N70-33756*# Utah Research and Development Co., Inc., Salt Lake City.
CO-AXIAL PLASMA GUN STUDY Final Report
Apr. 1970 21 p
(Contract NAS9-9584)
(NASA-CR-108495; Rept-801/486-1301) Avail: CFSTI CSCL 20I

This study was initiated to determine the feasibility of accelerating small projectiles to meteor velocities by exposing them to a stream of high density, fast moving plasma. The work reported here is the result of a study in which the final velocity of the particles which were accelerated determined feasibility of the method. Diagnostic techniques were simple and only a rudimentary attempt was made to determine the integrity of the projectiles after they had been accelerated. The question of particle ablation as the projectile traveled through the range was not considered to be pertinent at this time. The goal of this project was to accelerate projectiles whose diameter was 100 microns or greater to velocities of at least 20 km/sec. This final report reviews the simple theory of co-axial plasma guns and some of the problems which may be encountered. The experimental approach used are presented as well as the results of the firing program. Those results are analyzed and recommendations of future work are listed. Author

N70-33875# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
TEMPERATURE AND DENSITY MEASUREMENTS OF INDUCTION HEATED FREE JETS OF NITROGEN AND NITROGEN SEEDED ARGON
Yoshihiro Nakamura Feb. 1970 54 p refs
(Grant AF-AFOSR-697-67)
(AD-705663; USCAE-116; AFOSR-70-0448TR) Avail: CFSTI CSCL 20/4

The rotational and vibrational temperatures of nitrogen molecules on the centerline of a low density free jet exhausted through an orifice of 0.5 inch diameter are measured spectroscopically using electron beam excitation. The working gases are pure nitrogen and mixtures of argon and nitrogen. The gas temperatures are elevated by induction heating. The vibrational temperature is frozen from the orifice and the rotational temperature is frozen far downstream from the orifice. Measurements of pure nitrogen free jets imply that the effect of the stagnation conditions on the rotational freezing is described by the parameter PoD/T to the 4/3rd power instead of PoD which is used as a freezing parameter for a free jet at a constant stagnation temperature. The high rotational temperature is determined by comparison between experimental and theoretical distributions of total line intensities of R- and P- branches over the wave length of the first negative system. The rotational temperature of a small percentage of nitrogen molecules in the argon free jet is shown equal to the translational temperature of argon in the higher density region near the orifice. By this devise the seeded argon jet is investigated. Representative Langmuir probe data is discussed. Author (TAB)

N70-33902# Transtek Associates, Reading, Mass.
INTERACTION OF A STRONG HIGH-FREQUENCY ELECTROMAGNETIC FIELD WITH PLASMA
V. P. Silin Feb. 1970 58 p refs Transl. into ENGLISH from Russian Report Presented at the 8th Intern. Conf. on Phenomena in Ionized Gas, Vienna, 27 Aug.–2 Sep. 1967 Prepared for Princeton Univ.
(Contract AT(30-1)-1238)
(MATT-Trans-96) Avail: CFSTI

Since the free electrons of a plasma are particularly susceptible to the effect of an electric field, highly specific phenomena that occur under the effect of a strong HF field are possible in a completely ionized plasma. These phenomena turn out to be possible under conditions where the oscillation rate of the electrons becomes large by comparison with their thermal velocities. Here, the natural oscillations of the plasma turn out to be determined by an external HF field. Plasma instabilities occur that should lead to agitation of the plasma by the strong FH field has a stabilizing effect on the unstable states of the plasma. A review is presented of the theory predicting an entire series of such phenomena. Author (NSA)

N70-33925# Avco Government Products Group, Lowell, Mass. Avco Applied Technology Div.
AN INVESTIGATION OF MPD ACCELERATIONS Final Technical Report, 1 Dec. 1967 - 30 Nov. 1968
A. C. Malliaris and D. R. Libby Wright-Patterson AFB, Ohio ARL Jan. 1970 115 p refs
(Contract F33615-67-C-1209)
(AD-705633; AVATD-0171-69-RR; ARL-70-0011) Avail: CFSTI CSCL 20/9

An MPD accelerator is considered. A typical axisymmetric configuration is used and several experiments are carried out concerning MPD acceleration of six gases: hydrogen, deuterium, helium, ammonia, nitrogen, and argon. Flow rates range from 5 to 250 mg/sec depending on gas and other conditions. Accelerator currents were varied from 100 to 2000 amperes and externally applied magnetic fields from zero to 2200 gauss. Under such conditions the ambient pressure in the environmental tank could be maintained in the range of 10 to 100 microns Hg, except in cases where a higher pressure was deliberately set. Four separate subjects are investigated by experimental work and by analytical interpretation of the data: (a) uniformity and stability of the electrical discharge, (b) experimental evaluation of environmental interference by entrainment, (c) velocity determination by Doppler shift measurements, and (d) examination of acceleration mechanisms. In this last subject two topics receive particular attention by experimental data interpretation: acceleration of ions versus acceleration of neutrals and plasma (mass) rotation. Author (TAB)

N70-34089*# Techtran Corp., Glen Burnie, Md.
THEORY OF THE STABILITY OF SOUND IN A NONHOMOGENEOUS MEDIUM [K TEORII USTOYCHIVOSTI ZVUKA V NEODNORODNOY SLABO IONIZOVANNOY PLAZME]
S. A. Triger Washington NASA Aug. 1970 8 p refs Transl. into ENGLISH from Proc. of a Symp. on Magnetohydrodyn. Elec. Power Generation (Salzberg), v. 2, 1966 p 409 - 413 Submitted for publication
(Contract NASw-2037)
(NASA-TT-F-13137) Avail: CFSTI CSCL 20I

Using the three-liquid magnetohydrodynamics model in the linear approximation, the potential oscillation spectrum of a weakly-ionized plasma with a current flowing perpendicular to the applied magnetic field is discussed. A differential equation is obtained for oscillations propagated in such a system across the external magnetic field, and the equation is analyzed in the geometrical optics approximation. It is shown that in a dissipative medium considerable effect on the stability of sound oscillations results from systematic consideration of the nonhomogeneity of the ground state of the system. Increments of the sound oscillations are found, and stability criteria are obtained which differ from those previously known. The low-frequency and high-frequency (in relation to sound) limits of the derived equation are discussed. Author

N70-34179# Dartmouth Coll., Hanover, N.H. Dept. of Physics.
STUDY OF HYDROMAGNETIC WAVE-PARTICLE BEAM INTERACTIONS Final Report, 1 Dec. 1964 - 30 Nov. 1969
Forrest I. Boley 28 Feb. 1970 10 p
(Contract AF 49(638)-1481)
(AD-705265; AFOSR-70-0444TR) Avail: CFSTI CSCL 20/9

The behavior of organized groups of particles in a plasma has been studied to determine the effects of the scattering and diffusion of these particles on the plasma. In one experiment the particle group was an electron beam injected into a neutral gas thereby producing ionization and turbulent effects. Energy and spectral analysis of the beam particles and plasma turbulence are presented. In another experiment the particle group consisted of the plasma electrons gyrating at the upper hybrid frequency. The scattering of radiation from a column of such a magnetoplasma was studied. Amplitude and spectral measurements have been correlated with an improved theoretical model. Author (TAB)

N70-34212# Bar-Ilan Univ., Ramat-Gan (Israel). Dept. of Physics.
MEASUREMENT OF VERY HIGH TEMPERATURES Final Scientific Report, 1 Oct. 1967 - 31 Jul. 1969
Asher S. Kaufman 21 Dec. 1969 8 p refs
(Contract F61052-68-C-0005)
(AD-705154; ONR-012-308) Avail: CFSTI CSCL 20/9

In view of the importance of the distinction between thermal motion and random mass-motion in a plasma, effort has been devoted to the analysis of the velocity field from the Doppler broadening of spectral emission-lines. Work which can be fruitfully undertaken in the future is outlined. Author (TAB)

N70-34322 National Lending Library for Science and Technology, Boston Spa (England).
LIGHT SCATTERING AS A PLASMA DIAGNOSTIC TECHNIQUE
L. A. Dushin et al 9 Apr. 1970 40 p Transl. into ENGLISH from the book 'Plasma Investigation by Lasers' Moscow, 1968 p 96 - 143
(NLL-CTO-635-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: .4 NLL photocopy coupons

The state of plasmas is studied by using the spectrum of monochromatic light scattering. The experimental techniques with various laser beams are described. These laser plasma diagnostic techniques were applied successfully to dense plasmas. F.O.S.

N70-34346*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FIRST-ORDER EFFECTS OF PLANE SURFACES ON THE KINETIC BEHAVIOR OF GASES
Willard E. Meador Washington Aug. 1970 22 p refs
(NASA-TN-D-5909; L-7281) Avail: CFSTI CSCL 20I

A linearized Boltzmann equation is solved exactly for the problem of constant velocity and temperature gradients in a semi-infinite gas of Maxwellian particles. Contrary to similar previous work, the solution satisfies all physical requirements at the boundary without the introduction of complex exponential terms which are nonanalytic in the mean free path. The results apply also to simple Couette flow and are accurate over a range of Knudsen numbers extending well into the transition flow regime. Less rigorous extensions to large flow velocities are investigated in the midst of the gas. Author

N70-34400*# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
INVARIANT IMBEDDING TECHNIQUE APPLIED TO THE PROPAGATION OF ELECTROMAGNETIC WAVES THROUGH INHOMOGENEOUS REENTRY PLASMAS
Terence Glenn Ryan and Robert B. Heller 7 Jun. 1970 51 p refs
(Grant NGR-09-010-053)
(NASA-CR-66974) Avail: CFSTI CSCL 20I

The problem of predicting electromagnetic propagation losses encountered between a spacecraft and ground station during spacecraft reentry conditions is considered. The propagation characteristics (specifically, transmission loss) of electromagnetic energy through inhomogeneous plasma engulfing the reentering spacecraft are determined. The physical and electrical characteristics of the reentry plasma were established and a computational procedure was developed to calculate the propagation characteristics. The reentry plasma characteristics were determined by performing an extensive literature survey covering both theoretical and measurement techniques used to describe the nature of the plasma.

The propagation computations were carried out by applying the principles of the invariant imbedding procedure to the solution of the wave equation in an inhomogeneous plasma. The Riccati type differential equation resulting from the invariant embedding approach was solved, using certain approximation, to yield values of reflection from and transmission through the inhomogeneous plasma region formed about a reentering spacecraft. Author

N70-34450# Transtek Associates, Reading, Mass.
STUDY OF PLASMA IN CONFINEMENT IN CIRCULAR 1 EQUALS 2 STELLARATORS
M. S. Rabinovich et al Feb. 1970 21 p Transl. into ENGLISH from Russian report Prepared for Princeton Univ.
(Contract AT(30-1)-1238)
(MATT-Trans-100) Avail: CFSTI

Properties of stellarators for computer simulation purposes are briefly discussed. The basic characteristics of the magnetic fields used for plasma confinement are described. Plasma data taken from the 1 = 2 stellarator are given. These include information on density, temperature, potential, electric fields, and magnetic fields. NSA

N70-34550# McElroy (Ralph) Co., Austin, Tex.
LASER-PLASMA PRODUCTION SYSTEM FROM A SINGLE SOLIDIFIED GAS PARTICLE
Tadashi Sekiguchi et al [1970] 6 p Transl. into ENGLISH from Tokyo Daigaku Kogakubu Kiyo (Tokyo), no. 6, 1968 p 36 - 37 Transl. for Los Alamos Scientific Lab.
(LA-TR-70-6) Avail: CFSTI

Any kind of gas except helium (particularly Xe and H in these experiments) is frozen into a solid column, 0.4 mm in diameter and about 0.7 mm long, which is moved in a vacuum chamber by a thin pipe and remains hanging down. The column is reshaped into a desired size at its root as a result of gradual evaporation, and is then cut by a low-power laser pulse thermally or by a thin blade mechanically. The light signal scattered from the falling column triggers a Q-switched laser. The laser light pulse is focused on a particle isolated at the center of a vacuum chamber to produce high-temperature and high-density plasma. Plasmas produced by such a unique method offer most appropriate means to study the interaction mechanism between hot dense plasmas and magnetic field configurations of any type. NSA

N70-34861* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD AND APPARATUS FOR PRODUCING A PLASMA Patent
Arlen F. Carter, inventor (to NASA) Issued 17 Aug. 1965 (filed 7 Mar. 1962) 4 p Cl. 313-156
(NASA-Case-XLA-00147; US-Patent-3,201,635;
US-Patent-Appl-SN-178215) Avail: US Patent Office CSCL 20I

An apparatus for producing a highly conductive plasma with 10 to the 16th power electrons/cu cm and having a homogeneous temperature and pressure distribution is described. An electric arc, maintained between the electrodes, produces a high temperature gas jet which is then seeded and mixed with a vaporized ionizing agent. Alkali metals are preferred as ionizing agents because of their low ionization potential. N.E.N.

N70-34785 National Lending Library for Science and Technology, Boston Spa (England)
A PLASMA DIFFUSION PARADOX IN TOROIDAL MAGNETIC TRAPS
R. Z. Sagdeev et al 1970 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk (USSR), v. 189, no. 6, 1969 p 1204 - 1207
(NLL-CTO-721-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.; .1 NLL photocopy coupons

In toroidal magnetic traps the axial component of generalized momentum and the coefficient of diffusion in a tenuous plasma are examined. The diffusion was found not to be ambipolar until some equilibrium electric field distribution is established in the plasma. It was also found that the ambipolar diffusion coefficient is explicitly dependent on the frequency of collisions between particles of the same kind, electron-electron. This seemed paradoxical, therefore, the physical meaning of the apparent self-diffusion paradox was investigated. S.S.

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-33427# National Research Council of Canada, Ottawa (Ontario).
PHOTOMECHANICAL EFFECT IN IONIC CRYSTALS [FOTOMEKANICHNII EFEKT V IONIKH KRISTALAKH]
M. Ya. Goridko et al 1970 11 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 11, no. 9, 1966 p 1016 - 1022 /ts No. 187
(NRC-TT-1407) Avail: CFSTI

The photomechanical effect was investigated in NaCl, KCl, and LiF samples not subjected to treatments which color the crystals. The crystals were grown by the Kiropulos method, annealed, and split along the cleavage planes. Microhardness measurements were made with the specimens illuminated and in the dark. The crystals were also etched with hydrolytic alcohol saturated with cadmium chloride, and the dislocation structure was measured. The photomechanical effect was discovered, with a decrease in microhardness from approximately 25% to 30%. It was found that the effect takes place in the 90 C to 120 C temperature range. The photomechanical effect was also found to occur to depths of 19 microns, much greater than in semoconductor crystals. It is suggested that the effect is caused by increased mobility of edge dislocations in the illuminated sample. N.E.N.

N70-33428# Battelle Memorial Inst., Columbus, Ohio.
NUMERICAL SOLUTION OF THE EQUATION GOVERNING NUCLEAR MAGNETIC SPIN LATTICE RELAXATION IN A PARAMAGNETIC-SPIN DOPED INSULATOR Annual Report, 22 May 1969 - 22 May 1970
Jerome I. Kaplan 22 May 1970 17 p refs Submitted for publication
(Contract N00014-69-C-0218)
(AD-706047) Avail: CFSTI CSCL 20/12

A numerical solution of the equation governing nuclear relaxation in a paramagnetic-spin doped insulator has been obtained. The results are given. TAB

N70-33435# Illinois Univ., Urbana. Coordinated Science Lab.
PHOTOLUMINESCENT PROPERTIES OF VACUUM DEPOSITED CADMIUM SULFIDE FILMS
William Paul Bleha, Jr. (Ph.D. Thesis) Jan. 1970 128 p refs
(Contracts DAAB07-67-C-0199; DAAK02-67-C-0546)
(AD-700269; R-454) Avail: CFSTI CSCL 20/12

Green and blue photoluminescence has been observed below 100 degrees K in vacuum deposited, low resistivity CdS films given no post deposition treatment. The films were deposited in a heated chamber inside the bell jar on fused quartz substrates held at temperatures from 140-180 degrees C. The background pressure in the vacuum system was 0.000 001 Torr. The evaporant used was chlorine-doped CdS powder. The chlorine doping activated the luminescence and gave films that had resistivities at 300 degrees K in the range of from 1 to 100 ohm-cm parallel to the substrate.

The green luminescence in the films at 77 degrees K was similar to the emission reported for donor-doped CdS. The green emission spectra observed at 10 degrees K became better resolved than at 77 degrees K, and the peak position shift with temperature was small. The blue emission peak observed in the films was at 4892 A at 77 degrees K, which is in the fundamental absorption edge. Some of the literature relating to the theory and practice of CdS vacuum deposition is reviewed. Also a summary of the properties of the green luminescence of pure and donor-doped CdS is given. Author (TAB)

N70-33436# Institute of Nuclear Research, Warsaw (Poland).
SILICON DETECTORS OF NUCLEAR RADIATION FROM HOMEGROWN PRODUCTION MATERIAL [DETEKTORY KRZEMOWE PROMIENIOWANIA JADROWEGO Z MATERIALU PRODUKCJI KRAJOWEJ]
E. Belcarz, J. Chwaszczewska, W. Przyborski, and W. Wojciechowska 1969 12 p refs In POLISH; ENGLISH summary (INR-1135) Avail: AEC Depository Libraries

The characteristics of Si(Li) detectors, Si(Li) detectors with surface barrier and Si(Li) detectors with surface barrier and with the guard-ring were studied. The detectors were prepared from either imported or homemade material. The optimum temperature conditions with respect to the maximum energy resolution has been found. Author (NSA)

N70-33507# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
DYNAMIC EFFECTS IN HARD SUPERCONDUCTORS
M. Spadoni 23 Mar. 1970 26 p refs Presented at the Intern. School of Appl. Phys. on Develop. of Appl. Superconductivity, Erice, Italy, Apr. 1969 Submitted for publication *Its* Nota Interna No. 470
(LNF-70/12) Avail: CFSTI

After an introductory talk about the differences between the three classes of known superconductors, a panoramic account of the dissipative phenomena in type 2 and hard superconductors is given. Flux flow resistivity, flux creep and flux jumps are discussed, and a bibliography is provided. Author

N70-33512# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Reaktorzentrum.
INFLUENCE OF SURFACE FORCE CONSTANT CHANGES ON SURFACE MODE FREQUENCIES
S. W. Musser and K. H. Rieder 1970 8 p refs Submitted for publication
(SGAE-M-28/1970) Avail: CFSTI

Surface mode dispersion relations for the (01)- direction of the (100) surface of a nickel crystal are compared for various values of the surface coupling constants. Author

N70-33514# National Research Council of Canada, Ottawa (Ontario).
FLUORESCENCE DECAY TIME OF NAPHTHALENE CRYSTALS [DIE ABKLINGDAUER DER FLUORESZENZ VON NAPHTHALIN-KRISTALLEN]
T. B. El-Kareh et al 1970 11 p refs Transl. into ENGLISH from Z. Naturforsch. (Tuebingen), 22a, 1967 p 1242-1246
(NRC-TT-1404) Avail: CFSTI

The decay behaviour of naphthalene crystals was investigated as a function of the thickness and temperature of the crystals and the differing oscillator strengths of the transitions were taken into account. It is shown that despite the participation of two levels in the radiation process the decay follows an exponential course and in the temperature range of 4.2 to 300 K depends only slightly on temperature. This fact is important to two temperature-dependent processes which influence the decay time in opposite directions by prolonging the decay process as a result of increasing reabsorption with increasing temperature and shortening the duration due to higher occupation of the B level. In the evaluation it is assumed for the sake of simplicity that the quantum yield and the oscillator strengths are independent of the temperature. Author

N70-33523# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
INTRODUCTORY NOTES ON THE STABILIZATION OF SUPERCONDUCTING MATERIALS
M. V. Ricci 26 Feb. 1970 19 p refs Presented at the Intern. School of Appl. Phys. on Develop. of Appl. Superconductivity, Erice, Italy, Apr. 1969 Submitted for publication *Its* Nota Interna No. 468
(LNF-70/10) Avail: CFSTI

Alternate approaches to the problem of stabilizing a superconducting magnet are discussed. Conductors whose minimum propagating current is equal to their critical current were used in several intermediate sized magnets. Enthalpy stabilization was used in small coils. It is pointed out that it is difficult to relate theories and experiments since a particular conductor can be stabilized from the point of view of more than one of the theories explained. Author

N70-33585# Post Office Engineering Dept., London (England). Research Dept.
STRESS IN SILICON FILMS DEPOSITED HETEROEPITAXIALLY ON INSULATING SUBSTRATES WITH PARTICULAR REFERENCE TO CORUNDUM, SEPTEMBER 1967 - APRIL 1968
D. M. Jefkins 24 Jun. 1969 17 p refs
(Rept-85) Avail: CFSTI

The stresses in a thin silicon film deposited epitaxially on to a corundum substrate, arising from the differences in thermal expansion, are considered theoretically and the results compared with published experimental data. It is shown that the stress problem in such films cannot be overcome in the context of the two layer system though some alleviation can be obtained by the application of stringent dimensional conditions. Theoretical considerations show that the use of a third layer of material as a backing for the corundum substrate can reduce the stress at the silicon-corundum interface to zero and at the silicon surface to a negligibly small value. Author

N70-33688# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
POLYCRYSTALLINE SEMICONDUCTORS BY c-v MEASUREMENTS [GRENZSCHICHTUNTERSUCHUNGEN AN MIS-DIODEN MIT POLYKRISTALLINEN HALBLEITERN MITTELS c-v-MESSUNGEN]
Rudolf Lindner (Ph.D. Thesis) 1969 25 p refs In GERMAN
Avail: CFSTI

Calculated are the effects of doping profiles, traps, and grain boundaries on the capacity voltage characteristics of ideal metal insulator semiconductor diodes. Neglect of these semiconductor characteristics leads to faulty evaluation of surface density properties. Slow surface properties at high densities are proven for Ta2O5-CdS diodes; they constitute isolator traps that are reloaded by a tunnel mechanism. Transl. by G.G.

N70-33692# Rutgers Univ., New Brunswick, N.J. Dept. of Physics.
STUDIES OF SUPERCONDUCTIVITY Final Report, 1 Jul. 1968 - 30 Jun. 1969
Bernard Serin Jan. 1970 13 p refs
(Contract DAAB07-68-C-0299)
(AD-705392; Rept-4) Avail: CFSTI CSCL 20/3

A narrative account is given of the achievements which include: (1) Studies of the proximity effect between indium alloy films and manganese films using thermal conductivity measurements.

These have demonstrated the existence of gapless behavior down to the lowest temperatures. Assuming the existence of low-lying excitations in the neighborhood of the superconductor-manganese interface qualitatively accounts for the data. (2) Measurements of the surface reactance of lead films in proximity with a gadolinium film. The data for both the dependence of transition temperature on thickness and for the temperature dependence of the imaginary part of the conductivity are in good agreement with calculations based on the Ginzburg-Landau equations and on microscopic theory. (3) Studies of the effect of a transverse magnetic field on fluctuations in the conductivity of lead films above Tc. It was demonstrated that the extra conductivity in a magnetic field is a universal function of reduced temperature divided by field. In zero field and particularly at high temperatures there is more conductivity than predicted by the Aslamazov-Larkin theory. Author (TAB)

N70-33782*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOME PERFORMANCE CHARACTERISTICS OF DIVERGENT-FIELD BOMBARDMENT THRUSTERS

Harold R. Kaufman and Richard P. Vahrenkamp [1970] 11 p refs Presented at 8th Elec. Propulsion Conf. Stanford, Calif. 31 Aug.–2 Sep. 1970; Sponsored by AIAA

(NASA-TM-X-52861) Avail: CFSTI CSCL 20L

An experimental investigation was conducted with electron-bombardment thrusters employing highly divergent magnetic fields and using mercury propellant. The performance of the thrusters was found to the first approximation to be independent of configuration changes that did not affect the primary-electron region. Maximum propellant utilizations were also observed, where an increase in emission produced no increase or a small decrease in beam current. The value of the maximum utilization increases with an increase in total propellant flow rate. The study indicates that maximum utilization corresponds to only primary electrons being in the primary-electron region of the chamber. Double-valued ion chamber performance was obtained over a substantial range of utilization for one configuration. Author

N70-33776# Sandia Corp., Albuquerque, N.Mex.

CIRCUIT FOR MEASURING AC HALL VOLTAGES OF THIN FILM SEMICONDUCTORS

J. B. Snelling Mar. 1970 15 p refs

(SC-DR-70-145) Avail: CFSTI

The circuit uses an I(dc)-B(f2)-V(f2) technique. The sample is placed in a 20 Hz ac magnetic field and a dc current is passed through the semiconductor. The ac Hall voltage is monitored by a lock-in voltmeter. Errors due to misalignment voltages and thermal effects are eliminated by using the ac field. Accuracy of the data is limited by the amplitude response of the amplifiers and the accuracy of monitoring instruments, and is estimated at 2%. Author

N70-33781# Technische Hogeschool, Eindhoven (Netherlands).

AN INVESTIGATION OF THE STRUCTURE AND THE ELECTRICAL PROPERTIES OF OXIDIC MANGANESE-IRON-SPINELS [EEN ONDERZOEK NAAR DE STRUKTUUR EN DE ELEKTRISCHE EIGENSCHAPPEN VAN OXIDISCHE MANGAANIJZERSPINELLEN]

Victor Antonius Maria Brabers 1970 104 p refs In DUTCH; ENGLISH summary

Avail: CFSTI

A survey is given of the literature on the structure, the preparation, and the electrical properties of these oxides. Experimental techniques which are used for the measurements and for the preparation of the poly- and single-crystalline samples are reviewed. The infrared spectra in the range from 200 to 700 cm/1 of the cubic and tetragonal manganese-iron-spinels are reported. An analysis of the spectra is made with a model by which the lattice vibrations of the tetragonal spinels are classified into species of the pointgroup, on the analogy of the classification for cubic spinels. From the splitting of the absorption bands in cubic ferrites, it is concluded that there are local tetragonal distortions originating from the Jahn-Teller effect of the octahedral Mn(3+)-ions. Further, it was concluded that the infrared spectra are not in contradiction with the simultaneous occurrence at low temperatures of Fe(2+) and Mn(3+) on octahedral sites. Author

N70-33782# Emmanuel Coll., Boston, Mass. Oriental Science Research Library.

EFFECTS OF IMPURITIES ON THE HYDROTHERMAL REACTIONS OF ALUMINA

Shuitiro Ono et al Mar. 1970 35 p refs Transl. into ENGLISH from Yogyo Kyokai Shi (Tokyo), v. 76, no. 7, 1968 p 207–218

(Contract F19628-68-C-0251)

(AD-705538; Emm-69-237; AFCRL-70-0157; Trans-67) Avail: CFSTI CSCL 11/2

Corundum (Al_2O_3) was obtained from boehmite (AlOOH) under hydrothermal conditions at temperatures above 400C. The grain size of the crystals with definite habits was 10 to 100 microns. The effects of impurity on the crystallization process of corundum were investigated. It was found that the reaction rate, crystal size and habit, and incorporation of added ions were strongly influenced by temperature change, pH change, and addition of impurities into the solution. These observed data were explained as the results of impurity effects on the solvent structure, solution structure, solubility, diffusion process, nucleation process, and growth process. Habit modification of corundum by adding iron-group ions as sulfate, nitrate, chloride, hydroxide or oxide was determined. Copper ion is not solid-soluble in corundum if sulfate ion coexists; it is solid-soluble substitutionally as Cu(3+) in six coordinated sites if it is added as nitrate, oxide or hydroxide. TAB

N70-33787# Comitato Nazionale per l'Energi Nucleare, Frascati (Italy).

SUPERCONDUCTIVITY IN ELECTRONICS [LA SUPERCONDUTTIVITA NELL'ELETTROTECNICA]

G. Sacerdoti 4 Mar. 1970 63 p refs In ITALIAN *Its* Nota Interna No. 464

(LNF-70/5) Avail: CFSTI

The preparation of superconducting alloys is described for niobium-tin, niobium-thallium, and vanadium-gallium. The stabilization processes for the materials are presented, and the costs of production, and applications to electronics are discussed. Transl. by F.O.S.

N70-33874# Pennsylvania Univ., Philadelphia. Dept. of Physics.

NUCLEAR STUDY OF ATOMS AND IONS IN SOLIDS AND LIQUIDS Final Report, 15 Jan. 1967–14 Jan. 1970

M. E. Caspari 15 Apr. 1970 7 p

(Contract DAHC04-67-C-0029)

(AD-705662; AROD-6936-5-P) Avail: CFSTI CSCL 20/12

The report presents the results of the work which was concerned with measurements of hyperfine interactions on various atoms and ions in solids using the techniques of the Mossbauer effect and perturbed gamma-gamma angular correlations. The work has yielded information regarding magnetic fields and electric field gradients at the nuclear sites in materials such as magnetic alloys, garnets, and other rare-earth metals and compounds as well as the magnetic dipole and electric quadrupole moments of excited nuclear states. Author (TAB)

N70-33888# Harry Diamond Labs., Washington, D.C.

DIRECT SPIN-CRYSTAL FIELD INTERACTION IN SOLIDS

Clyde A. Morrison Mar. 1970 63 p refs

(AD-705564; HDL-TR-1482) Avail: CFSTI CSCL 20/12

The study was made to investigate the consequences of the first-order relativistic corrections to the Schroedinger equation for an ion in a nonspherically symmetric potential. Author (TAB)

N70-33893# Cornell Univ., Ithaca, N.Y. Materials Science Center.
THE R' CENTER IN LiF: AN OPTICAL STUDY OF A JAHN-TELLER DISTORTED SYSTEM
Jeffery Arthur Davis (Ph.D. Thesis) Jan. 1970 124 p refs
(Contract AT(30-1)-3464)
(NYO-3464-21; Rept-1238) Avail: CFSTI

A series of experiments are described in which the optical absorption and emission spectra of the R' center in LiF at low temperature are perturbed by applied electric, magnetic, and uniaxial stress fields to determine the structure of the center and the effects of Jahn-Teller distortion in its excited state. These effects are analyzed quantitatively in terms of the well-known LHOPS model for the linear Jahn-Teller effect in an X sub 3 molecule and are all consistent with the choice of model parameters for the strength of the interaction, and the frequency of the mode responsible for the distortion. Other predictions of the model based on these parameters, such as the linearity of the Stark and Stress splitting of the zero-phonon line in absorption are qualitatively confirmed. No evidence of warping effects due to higher order terms in the Jahn-Teller coupling is observed. Author

N70-33909# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna.
INFLUENCE OF APPLIED STRESS AND DEFECT ATOMS ON THE ATOMIC VIBRATIONS IN SOLIDS AND LIQUIDS Final Report, 1 Oct. 1968 - 30 Sep. 1969
P. Weinzierl 4 Feb. 1970 37 p refs
(Contract F61052-69-C-0006)
(AD-705668; AFOSR-1098-TR) Avail: CFSTI CSCL 20/12

A sodium single crystal sample was tested, adopted to the scattering chamber and a series of systematic exploratory measurements has been done with the aim to find favourable conditions for the subsequent pressure-induced phonon frequency shift measurements. An improved control system for the triple-axis spectrometer driven by paper tape has been completed and put in operation. A calculation on the surface vibrations in crystal using an improved force constant model and some unusual methods was done resulting in a values of Debye-Waller factors and of dispersion relations for surface modes in small crystals. Author (TAB)

N70-33938# Brookhaven National Lab., Upton, N.Y.
NUCLEAR ANTIFERROMAGNETISM IN SOLID HELIUM 3
Wiley Price Kirk Jan. 1970 156 p refs Sponsored by AEC
(BNL-14363) Avail: CFSTI

The nuclear magnetic susceptibility in bcc solid He-3 has been measured between temperatures of 5.3 mK and 800 mK for molar volumes between 21.0 and 24.0 cc/mole. In each case, the susceptibility followed a Curie-Weiss law with a negative Curie-Weiss constant, hence a negative exchange interaction energy J. Magnetic behavior of this type is expected for an antiferromagnet. The Neel temperature as computed from each Curie-Weiss constant decreased when the molar volume decreased from 24.0 to 21.0 cc/mole respectively. Values of (J) as a function of molar volume were obtained from the Curie-Weiss constants. These values are compared with values obtained by different experimental methods, and good agreement is found with the values from the pressure measurements of Panczyk and Adams. The results are also compared with theoretical predictions. Author

N70-33991*# Office of Naval Research, Washington, D.C. Solid State Applications Branch.
SOLAR CELL RESEARCH, PHASE 2 Semiannual Report
R. L. Statler, J. E. Stannard, N. D. Wilsey, R. J. Lambert, and J. A. Pfaff 15 Apr. 1970 48 p refs Prepared for JPL
(Contracts NAS7-100)
(NASA-CR-109856) Avail: CFSTI CSCL 20L

Particular areas of study include investigating radiation effects in lithium-diffused silicon crystals, the measurement and evaluation of the properties of manufactured lithium solar cells, and the radiation effects on solar cells as a function of temperature and illumination. The objective of the silicon crystal study is to understand the radiation-damage effects in lithium-diffused solar cells. The approach to this task is to utilize the measurement of Hall coefficient in irradiated lithium-diffused silicon as a function of temperature, fluence, and post-irradiation thermal annealing time. Evaluated are also photovoltaic properties of manufactured lithium-doped solar cells functioning under illumination and subjected to irradiation at a level comparable to space flux. Sixty-five cells are irradiated by Cobalt-60 gamma rays at two temperatures in a statistically-designed experiment. Data has been obtained over a seven month period to a dose approximately equivalent to 1 x 10 to the 14th power 1 MeVe/sq cm. The last section of the program is concerned with measuring the effect of radiation on silicon solar cells at low temperatures. In conjunction with low-temperature irradiation, the photovoltaic properties are also measured at low temperatures as a function of intensity of illumination. Author

N70-33998*# Gulf General Atomic, San Diego, Calif.
RADIATION EFFECTS IN SILICON SOLAR CELLS Quarterly Progress Report, 1 Apr. - 30 Jun. 1970
B. C. Passenheim, R. A. Berger, J. F. Colwell, R. E. Leadon, and J. A. Naber 10 Jul. 1970 22 p refs Prepared for JPL
(Contract JPL-952387)
(NASA-CR-109803; GA-10219) Avail: CFSTI CSCL 20L

The present effort is concentrated on the study of the effects of lithium on the production and annealing of damage in silicon. This work is being performed on lithium-diffused bulk silicon using measurements such as minority-carrier lifetime, electron-spin resonance (ESR), electrical conductivity, and infrared absorption. The temperature range from 77.5 to 400 K is under investigation. The damage is introduced by 30-MeV electrons and fission neutrons. Thirty-MeV electrons produce defects similar to those produced by high-energy protons. Author

N70-34039# California Univ., La Jolla. Dept. of Physics.
THEORY OF METAL SURFACE: CHARGE DENSITY AND SURFACE ENERGY
N. D. Lang and W. Kohn 22 Jan. 1970 53 p refs
(Contract N00014-69-A-0200-6001)
(AD-701344; TR-3) Avail: CFSTI CSCL 20/12

The first part of this paper deals with the jellium model of a metal surface. The theory of the inhomogeneous electron gas, with local exchange and correlation energies, is used. Self-consistent electron density distributions are obtained. The surface energy is found to be negative for high densities (r sub s = or < 2.5). In the second part, two corrections to the surface energy are calculated which arise when the positive background model is replaced by a pseudopotential model of the ions. One correction is a cleavage energy of a classical neutralized lattice, the other an interaction energy of the pseudopotentials with the electrons. Both of these corrections are essential at higher densities (r sub s = or < 4). The resulting surface energy is in semiquantitative agreement with surface-tension measurements for eight simple metals (Li, Na, K, Rb, Ca, Mg, Zn, Al), typical errors being about 25%. For Pb there is a serious disagreement. Author (TAB)

N70-34050# Washington State Univ., Pullman. Shock Dynamics Lab.
SHOCK WAVES IN A ONE-DIMENSIONAL NON-DISSIPATING LATTICE
R. Manvi and G. E. Duvall 7 Mar. 1969 8 p refs Submitted for publication
(Grant AF-AFOSR-1088-66)
(AD-705892; AFOSR-70-1317TR) Avail: CFSTI CSCL 20/12

A one-dimensional lattice model is studied for shock wave propagation. Two types of non-linear nearest neighbour interactions are considered. Numerical solutions of the resulting differential-difference equations of motion are described.

Computations yield values of steady particle velocity which agree with predictions of the Rankine-Hugoniot jump conditions for a continuum; shock velocities exceed those predicted by the jump conditions by as much as 6%. Author (TAB)

N70-34088# Naval Research Lab., Washington, D.C. Solid State Technology Branch.
IN DOPING OF GaaS FILMS USING COEVAPORATION OF THE ELEMENTS Final Report
W. A. Schmidt and J. E. Davey 23 Apr. 1970 21 p refs
(AD-705486; NRL-7100) Avail: CFSTI CSCL 20/2

High optical quality polycrystalline thin GaAs films, in the thickness range from 1.0 to 10 micrometers and degenerately doped to levels of 3x 10 to the 19th power/cc, have been grown in a reproducible manner by the coevaporation techniques. An upper limit on the deposition temperature dictated by surface quality requirements results in the consistent observation of growth in the (311) or (111) textures and crystallite size significantly smaller than film thickness. This latter fact results in the mobility being limited by grain boundary scattering, the mobility being about two orders of magnitude smaller than for equivalently doped bulk GaAs. Using Zn diffusion methods on already deposited, undoped, high resistivity GaAs films results in large particle size but discontinuities in the films. Partial epitaxy on polycrystalline GaP substrates resulted in two-order-of-magnitude improvement in resistivity. These results tend to rule out use of polycrystalline GaAs films for applications where particle size of the order of film thickness is required. Epitaxial films are mandatory for equivalent bulk mobility applications. Author (TAB)

N70-34093# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODERN PROBLEMS SEMICONDUCTORS
B. M. Vul 20 Mar. 1970 25 p Transl. into ENGLISH from Prioroda (Moscow), no. 2, 1969 p 47-55
(AD-705844; FTD-MT-24-461-69) Avail: CFSTI CSCL 20/12

The article discusses properties, applications, and problems connected with semiconductors. Special attention is given to the developments in semiconductor physics resulting from the invention of the transistor. Problems which are to be solved for further progress in the field of semiconductors are discussed. A study is made of the physics of thin films, and laws governing the motion of current carriers are examined. A review is given of the results obtained in studies of optical effects, acoustical domains, semiconductor thermoelements, and superconductivity. TAB

N70-34098# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
ELECTRON PROBE ANALYSIS OF SEMICONDUCTORS
David B. Wittry Jan. 1970 13 p refs
(Grant AF-AFOSR-1414-68)
(AD-705251; USCEE-384; AFOSR-70-0331TR) Avail: CFSTI CSCL 20/12

The report summarizes the research in electron probe analysis of semiconductors performed under the grant. Contributions have been made in the following areas: (1) x-ray generation and absorption in electron probe analysis, (2) electron beam modulated optical properties of semiconductors, (3) electron spectrometry with the transmission electron microscope, and (4) cathodoluminescence of semiconductors. Author (TAB)

N70-34144# California Univ., Los Angeles. Dept. of Physics.
ULTRASONIC INVESTIGATION OF SUPERCONDUCTING PAIRS AND SPIN WAVES IN SOLIDS Final Report
Moises Levy 25 Mar. 1970 10 p refs
(Grant AF-AFOSR-1164-66)
(AD-705209; AFOSR-70-0916TR) Avail: CFSTI CSCL 20/12

The results of research on the following investigations are reported: the study of the properties of superconducting electrons by means of ultrasonic techniques; the study of the interaction of nuclear spin waves; and the study of spin-phonon interaction in the rare earth metals. In the mixed state of pure superconductors it is found that the interacting electrons spatially average the order parameter. Measurements in both the normal and superconducting state of rhenium are reported. These data will yield values of the deformation potential in rhenium. The apparent difference in zero temperature energy gaps obtained in a pure superconductor, when low and high temperature data are used to predict the gaps, is resolved. Progress on the nuclear-spin-wave-phonon experiments is reported. A mechanism is theoretically proposed and experimentally verified for spin-phonon interaction in the spin-spiral phase of the rare earth metals. The investigation of the effect of an external magnetic field on this spin-phonon interaction is reported. Author (TAB)

N70-34202# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
DIELECTRIC NONLINEARITY AND LOSS IN THE (Ba, Sr)Ti03 AND (Pb, Sr)Ti03 SYSTEMS
Charles R. Griffiths Feb. 1970 128 p refs
(AD-705374; ECOM-3233) Avail: CFSTI CSCL 20/3

Properties of dielectrics which offer promise in applications such as voltage-variable capacitors in automatic antenna matching circuits are reported. Eight ferroelectric compositions of different Curie temperatures, four in the (Ba, Sr)TiO3 system and four in the (Pb, Sr)TiO3 system, were prepared and variations of their dielectric constant and loss tangent at 1 MHz as a function of dc voltage were determined. The greatest change in dielectric constant with dc voltage, for those materials which maintained a loss tangent less than 0.01, was 3:1 exhibited by Ba(.65)Sr(.35)TiO3. TAB

N70-34207# North Carolina Univ., Chapel Hill. Dept. of Physics.
IMPERFECTIONS AND ELECTRICAL PROPERTIES OF IONIC CRYSTALS Final Report, Sep. 1966 - Aug. 1969
Lawrence M. Slifkin 20 Mar. 1970 9 p
(Grant AF-AFOSR-450-66)
(AD-705244; AFOSR-70-0804TR) Avail: CFSTI CSCL 20/12

Measurements of ionic conductivity in AgCl doped with ferrous and ferric ions were completed. The results were consistent with the tetravacancy model of the ferric ion. The activation energy of conductivity and of the reversion process from ferric to ferrous were estimated to be 8 and 15Kcals/mole respectively. Internal friction studies in AgCl yielded a value of 0.51eV for the formation enthalpy of the silver ion vacancy. The recovery process is explained in terms of dislocation pinning by point defects. Experiments on the injection of hot electrons in AgCl are still in the preliminary stage. Multiple spin echos arising from strong coupling of the spins to the resonant cavity were observed in TiO2:V4+. Spin-lattic relaxation of V4+ impurities in TiO2 was also measured at liquid helium temperatures. Author (TAB)

N70-34227# IBM Watson Research Center, Yorktown Heights, N.Y.
NONLINEAR PIEZOELECTRIC SURFACE ACOUSTIC WAVES Final Report, 1 Mar. 1969 - 28 Feb. 1970
E. G. Lean Mar. 1970 102 p refs
(Contract N00014-69-C-0222)
(AD-705139) Avail: CFSTI CSCL 20/12

A report is given of the results of the experimental and theoretical investigations of nonlinear effects in surface acoustic waves propagating on piezoelectric substrates. The nonlinear effects include the parametric interactions, harmonic generation, parametric mixing and amplification of surface acoustic waves, and interactions between light and surface acoustic waves. Author (TAB)

N70-34308# Army Electronics Command, Fort Monmouth, N.J. Inst. for Exploratory Research.
CRITICAL CURRENT STUDIES OF FLUX TRAPPING IN

SUPERCONDUCTING LEAD AND LEAD ALLOYS

J. J. Winter, J. T. Breslin, and H. A. Leupold Apr. 1970 34 p refs

(AD-705602; ECOM-3249) Avail: CFSTI CSCL 20/3

A convenient critical current method for observing the salient features of flux-trapping in superconductors was used to study a variety of lead (Pb) and lead-alloy samples. The critical fields H sub i, H sub a, and H sub c for type I and H sub c2 for type II superconductors were obtained and found to be in accord with the results of other investigators employing different techniques. Because of self fields due to current asymmetries, the full critical currents of some samples are observed in nonzero applied fields. The critical current vs applied magnetic field characteristics of lead pressure contacts and their application to a simple magnetic null detector are discussed. It was found that trapping flux in certain solid specimens can cause a fourfold enhancement of the peak critical current. Author (TAB)

N70-34496# Stanford Univ., Calif. Dept. of Materials Science.

THERMODYNAMIC PROPERTIES AND DEFECT STRUCTURE OF INTERMETALLIC COMPOUNDS Final Report, 1 May 1959 – 31 Dec. 1969

David A. Stevenson Mar. 1970 80 p refs

(Contract AT(04-3)-326)

(SU-326-P-25-10) Avail: CFSTI

Electrical and optical measurements were made on as-grown, Zn-annealed, and Te-annealed undoped and aluminum doped ZnTe. These measurements helped to clarify the defect levels in ZnTe crystals. Electric conductivity and Hall-effect measurements were made as a function of temperature on undoped ZnTe crystals. Aluminum doped crystals, in which the Fermi level was shifted toward the center of the band gap, were studied for the purpose of investigating defect levels other than those normally observed in low resistivity ZnTe. A study was also made on self diffusion of ZnSe under variable component partial pressure and impurity content. The diffusion and solubility of antimony in zinc selenide was studied. The influence of component pressure on the electrical properties of CdSe at high temperatures was investigated. Measurements were made on single crystals that were grown from the congruent melt using a vertical Bridgman technique. Since the properties of these compounds are sensitive to native and impurity defects, careful preparation of crystals was an essential starting point. NSA

N70-34519# California Univ., Livermore. Lawrence Radiation Lab.

RADIATION-ENHANCED DIFFUSION IN SILICON: A REVIEW AND ANALYSIS

Lawrence J. Ferderber 3 Mar. 1970 15 p refs

(UCRL-50799) Avail: CFSTI

The effects of radiation enhancement on defect concentration were studied in attempts to learn more about the diffusion process in Si. A brief mathematical description is given of the diffusion mechanism, as presently understood in which the role of lattice defects is established as a principal phenomenon in diffusion. The known and proposed defects are described. A survey of reported radiation-enhanced diffusion data is provided. Selected data are analyzed, and conclusions are reached as to the validity and significance of the reported data. The experimental results are compared with the existing theoretical predictions. Although no conclusive results are obtained, it is shown that vacancy-impurity complexes (in particular, the vacancy-oxygen complex) are probably the dominant defect associated with impurity diffusion in silicon. Author (NSA)

N70-34612# California Univ., Livermore. Lawrence Radiation Lab.

Ge CRYSTAL GROWTH AND EVALUATION AS Ge(Li) DETECTOR MATERIAL

R. Wichner, G. A. Armantrout, and T. G. Brown Mar. 1970 13 p refs Presented at the 12th Scintillation and Semicond. Counter Symp. Washington, D.C., 11-13 Mar. 1970 Sponsored by AEC

(UCRL-72108; Conf-700301-7) Avail: CFSTI

A comprehensive program of germanium single crystal growth and the evaluation of such material for use as Ge(Li) detectors is described. The effects of crystal growth parameters such as pull rate, cooling rate, crucible material, and atmosphere, among others, are analyzed by a number of techniques. These techniques include the standard etch-pit density, resistivity profile and minority carrier lifetime measurements as well as others which have been developed at this laboratory and have been shown to be extremely useful in characterizing the quality of single crystal germanium for Ge(Li) detectors. Author (NSA)

N70-34666*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FIELD AND PHOTON ENHANCED ELECTRON EMISSION CHARACTERISTICS OF CADMIUM SULPHIDE FIELD EMITTERS

Akram S. Husain-Abidi and Donald Walsh Jul. 1970 35 p refs Submitted for publication

(NASA-TM-X-63990; X-711-70-287) Avail: CFSTI CSCL 20L

Preparation and electron emission characteristics of cadmium sulfide field emitters are described. Experimental results when plotted in accordance with Fowler-Nordheim theory were found to depart from linearity. The departure from linearity in low field region is ascribed to the surface electron states and in high field region due to electron phonon interactions. Work function was also calculated from Fowler-Nordheim plots and was found to be smaller than the one measured by photoelectric method. Photon enhanced emission has been observed by shining the laser light of photon energy equal to the energy gap in cadmium sulfide. The maximum enhanced emission current was as high as 14,000 times the dark field emission current, when the exciting light was parallel to the c-axis and illuminated the entire effective emitting area of the crystal. Under pulsed excitation and at higher incident photon densities, an additional component of shorter decay time appeared in the enhance emission. The transient characteristics are discussed in terms of recombination centers and trapping levels in cadmium sulfide. Author

N70-34792# Joint Publications Research Service, Washington, D.C.

NEW SOVIET BOOKLET ON SOLID STATE PLASTICITY AND STRENGTH

B. I. Beresnev et al 17 Jul. 1970 14 p Transl. into ENGLISH from the book 'Plastichnost i Prochnost Tverdykh Tel'pri Vysokikh Davleniyakh' (Moscow), 1970 p 3, 5 – 7, 88 – 95, and 161 – 162

(JPRS-50959) Avail: CFSTI

The effect of high pressure on the physical and mechanical properties of solid states was studied in the following three basic areas: (1) Development of high-pressure equipment and procedures for studying the physical and mechanical properties of solid states under pressure. (2) Investigation of the strength, plasticity, creep and rupture of solid states directly under high-pressure conditions. (3) Study of the effect of preliminary deformation under high pressure on the variation of the physical and mechanical properties of solid states. A study of the effect of high pressure on creep in lime is presented. It is concluded that high pressure increases the capacity of solid states for creep deformations. F.O.S.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-33525# TRW Systems Group, Redondo Beach, Calif.
MODEL FOR THE BURNING RATE AND EXTINCTION OF ALUMINIZED POLYBUTADIENE AMMONIUM PERCHLORATE COMPOSITE PROPELLANTS
E. D. Guth, J. S. Land and G. Schlesinger Dec. 1969 23 p refs
(AD-706033; TRW-14089-7183-T0-00) Avail: CFSTI CSCL 21/2

A combustion model and burning rate equation for an aluminized polybutadiene ammonium perchlorate composite solid propellant was developed in terms of the rate of heat feedback to the propellant surface. The equation was used to calculate the propellant extinction behavior in test chambers with low (or subsonic) exhaust flow, and the C* extinction in test chambers exhausting with supersonic flow (i.e. rocket motors). These calculations agreed well with the observed extinction characteristics of the propellant. Author (TAB)

N70-34309# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
EXPERIMENTAL AND THEORETICAL STUDY OF NITRIC OXIDE FORMATION IN INTERNAL COMBUSTION ENGINES
George A. Lavoie, John B. Heywood, and James C. Keck Nov. 1969 40 p refs
(PB-190376; Publ-69-10) Avail: CFSTI CSCL 13B

The nonequilibrium formation of nitric oxide within the internal combustion engine cylinder is examined. A thermodynamic model which predicts the properties of the burnt and unburnt gases during the combustion process is developed. A set of reactions which govern the formation of nitric oxide is proposed, and rate equations for nitric oxide concentrations as a function of time in the post-flame gases are derived. The results of time-resolved measurements carried out on CFR engine are described, where emitted light intensities the CO + O and NO + O continua were used to determine the nitric oxide concentration. The comparison between theoretical and experimental results for fuel-lean mixtures confirms that the important features of the model presented are correct. Author (USGRDR)

N70-34783* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MANDREL FOR SHAPING SOLID PROPELLANT ROCKET FUEL INTO A MOTOR CASING Patent
Joseph G. Thibodaux, Jr. and Donald J. Lewis, inventors (to NASA) Issued 13 Jul. 1965 (filed 7 Sep. 1960) 5 p Cl. 18-39
(NASA-Case-XLA-00304; US-Patent-3,193,883; US-Patent-Appl-SN-54552) Avail: US Patent Office

A method and an apparatus for shaping a concavity within the fuel charge of a solid propellant rocket motor are described. A rocket motor casing is constructed with a nozzle aperture and a mandrel greater in diameter than the aperture. Cast propellant fills the concavity formed by the casing and mandrel. The mandrel is meltably removable from the casing after curing and solidification of the propellant without damage to the rocket motor casing and charge. E.C.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-33746*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF INLET AIR VITIATION ON THE PERFORMANCE OF A MODULAR COMBUSTOR BURNING NATURAL GAS FUEL
Arthur M. Trout and Nicholas R. Marchionna 31 Oct. 1969 15 p refs
(NASA-TM-X-52711) Avail: CFSTI CSCL 21E

An advanced turbojet combustor design was tested with natural gas fuel at a pressure of 45 psia (31N/sq cm) and inlet air temperature of 540 F (556 K). The inlet air was heated using both nonvitiating and vitiating preheaters. Combustion efficiency of the test combustor substantially decreased when the vitiating preheater was used. The combustion efficiency decreased most at high reference velocities and low fuel-air ratios. Author

N70-33752*# Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
CONTINUATION OF NASA ROCKET MOTOR DEFECTS INVESTIGATION, JUNE 1969 - MAY 1970
R. B. Enie May 1970 209 p refs
(Contract NAS1-9293)
(NASA-CR-66946) Avail: CFSTI CSCL 21H

The objective of this NASA program was to continue the investigation of methods by which damaged fiberglass rocket motors can be successfully repaired. The investigation of the repair system provided the following conclusions: (1) a stress analysis indicated that use of a rubber filler ply in the bond line between the parent case and the first ply can help to reduce peak shear stresses at the defect edge and make the loading in the patch plies more uniform; (2) the present four-ply fiberglass cloth patch design has inadequate strength to repair a 5.0-in. longitudinal defect completely through the wall of an X259 motor case cylindrical section; (3) bottle hydroburst tests indicate that the shear strength of the Epon 946 resin bounded patch is significantly greater than previously indicated by double-lap shear tests; (4) double-lap shear tests data indicated no significant loss in shear strength for the repair system after nine months of aging; and (5) for the best void-free application of a repair patch, individual plies must be applied separately. Except for the anti-fraying border, the resin must not be applied to any ply before positioning and rolling down the ply. Author

N70-33771*# Pratt and Whitney Aircraft, West Palm Beach, Fla.
A 90 DEGREE SECTOR DEVELOPMENT OF A SHORT LENGTH COMBUSTOR FOR A SUPERSONIC CRUISE TURBOFAN ENGINE Interim Report, Jun. 1968 - Mar. 1970
T. R. Clements 6 Aug. 1970 90 p refs
(Contract NAS3-11159)
(NASA-CR-72734; PWA-FR-3790) Avail: CFSTI CSCL 21E

Results of a performance development program are presented on an advanced short length combustor for operation at flight speeds up to Mach 3.0. The combustor has an outer diameter of 40 inches and a length of 12 inches. The overall diffuser-combustor length is 20 inches. Performance data were obtained in a 90-degree sector rig at a pressure level of 16 psia. Inlet temperature and Mach number simulated sea level take-off operation. Various combustor and diffuser configurations were investigated to simplify design and to improve performance. At a combustor temperature rise of 1640 F good outlet temperature pattern factor (TPF = 0.14), radial profile, and combustion efficiency (100%) were obtained. The combined diffuser-combustor total pressure loss was 5.6%. Author

N70-33773*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-NOISE PROPULSION SYSTEMS FOR SUBSONIC TRANSPORTS
James J. Kramer, Bruce R. Leanord, and Charles E. Feiler 21 Nov. 1969 26 p refs Presented at the Symp. on Machinery Noise, Los Angeles, 16-21 Nov. 1969; Sponsored by ASME
(NASA-TM-X-52640) Avail: CFSTI CSCL 21E

A brief review of the preliminary design studies which led to a definition of specifications for a low-noise output turbofan engine for use on long-range subsonic transport aircraft is presented. Data on low-speed fans with and without acoustic treatment in the fan ducting are presented. These data indicate that overall noise output of four-engine long-range transport aircraft can be reduced 20 perceived noise decibels by appropriate fan design and the use of nacelle acoustic treatment. Author

N70-33892*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LIQUID ROCKET TECHNOLOGY FOR THE CHEMICAL ENGINEER

Richard J. Priem 1969 41 p refs Presented at the 62d Ann. Meeting of the Am. Inst. of Chem. Engr., Washington, D.C., 16-20 Nov. 1969

(NASA-TM-X-52695; E-5342) Avail: CFSTI CSCL 21H

Recent rocket technological developments of interest to the chemical engineer are presented. The path of liquid propellants through a propulsion system is followed to illustrate the problems encountered in developing a lightweight and reliable system. As the problems are defined, the technical advancements made to overcome them are presented. Improved techniques for insulating tanks and providing for flexible lines are given. Data are presented to show how various parameters influence propellant sloshing and consumption of pressurizing gas when used with cryogenic propellants. Recent advances are presented for using combustion products to pressurize tanks. New methods for pumping cryogenic propellants that are near their boiling point are discussed. Methods for predicting the very high heat transfer rates encountered with accelerating gas streams in rocket engine combustors are presented. Author

N70-33961*# Dynamic Science, Irvine, Calif.

COMPUTER MODELING OF ROCKET ENGINE IGNITION TRANSIENTS Final Report

T. R. Mills and B. P. Breen May 1970 120 p refs

(Contract NAS7-467)

(NASA-CR-109865) Avail: CFSTI CSCL 21B

A computer program was written to describe transient propellant flow and the pressure/temperature and O/F histories with the chamber prior to ignition. Experimental tests were performed which confirmed the analytical findings. Ignition spiking occurred with fuel leads at low fuel temperature, and even at high fuel temperatures with long vacuum leads; while spiking was reduced by controlled valve opening sequences at nominal temperatures. The analytical study resulted in a propellant transient flow digital computer program and a chamber pressurization transient digital computer program which was used to obtain the engine starting characteristics. The data from the pressurization program is used to predict maximum pressures possible from the transient chamber fuel/oxidizer mixture environment. Author

N70-33979*# TRW Systems Group, Redondo Beach, Calif.

APOLLO LUNAR MODULE DESCENT ENGINE ABLATIVE CHAMBER-INJECTOR COMPATIBILITY IMPROVEMENT STUDY. TORCH TEST MATERIALS EVALUATION

11 Apr. 1969 64 p

(Contract NAS9-8229)

(NASA-CR-108469; TRW-11602-6026-RO-00) Avail: CFSTI CSCL 21H

The actual Lunar Module Descent Engine (LMDE) environment consists of at least four major components which combine, affecting materials behavior: thermal, reactive gas, velocity, and pressure. A methane-oxygen-nitric oxide mixture was used to approximate the thermal and reactive gas environment, but not the pressure and velocity effects. A large number of candidate throat materials were evaluated and compared for their thermo-chemical behavior under LMDE gas environments. Post torch test analysis criteria included visual examination, weight change and dimensional change (erosion). The procedures, results, and conclusions of the torch tests are discussed. Author

N70-33994*# Marquardt Corp., Van Nuys, Calif.

DESIGN STUDY AND EVALUATION OF A HYPERGOLIC ENGINE FOR A SPACE POWER SYSTEM, PHASE 2 Final Report, 1 Jul. 1964 - 10 Feb. 1966

M. Arao, B. R. Chandler, and A. I. Bratton 28 Feb. 1966 223 p refs

(Contract NAS9-857; Proj. 287)

(NASA-CR-109798; Rept-6098) Avail: CFSTI CSCL 21H

This report describes the design study and evaluation accomplished for the hypergolic engine feasibility program for a space power system. Under a simulated mission requirement of a two-level power profile cycling of 50 minutes at 2.4 HP and 10 minutes at 3.2 HP, a nonstop engine endurance run of 90.4 hours was made. A total of 377.4 hours of engine operation was accumulated. Improvements made to increase reliability often resulted in reduced specific propellant consumption. At the end of the program, a specific propellant consumption of 6.3 lb/HP-hr at 3.2 HP at 3200 rpm was obtained, corresponding to a BMEP value of 200 psi. During the endurance run program, it became necessary to improve the reliability of only one component -- the piston assembly. This resulted in the design a 4-ring type utilizing a composite of a heat resistant piston crown of Rene' 41 and a piston body of cast aluminum. However, the significant breakthrough in piston reliability resulted when 440C stainless steel was used for the ring material in place of high grade cast iron. Less significant developments included the flat poppet injector valves and circular exhaust ports. Author

N70-34008*# TRW Systems Group, Redondo Beach, Calif.

SIMPLIFIED ZERO GRAVITY AMMONIA FEED SYSTEM PROGRAM Final Report

May 1970 201 p refs

(Contract NAS5-21010)

(NASA-CR-109874) Avail: CFSTI CSCL 21H

The development and testing of a pneumatic-regulated ammonia propellant feed system for spacecraft applications are described. The feed system was assembled and subjected to a one-month demonstration test, which included operation over a range of ambient temperatures, flow rates, flow ON times and duty cycles. Steady-state propellant flow rates were in the range of 0.00003 to 0.001 lb/sec. Operation in the pulse flow mode was performed with duty cycles of 1 to 3 percent and flow ON-times of 50 to 300 milliseconds with flow rates during a pulse 0.0005 to 0.001 lb/sec. The system exhibited the capability of maintaining a delivered pressure within a + or - 5 percent bandwidth for all test flow conditions above 40 F. The upper level of the bandwidth increased to approximately 10 percent during pulsed operation with flow ON times of 300 milliseconds at temperatures below 40 F. This effect could be circumvented by increasing the system plenum volume. The system demonstrated design simplicity and performance capability similar to those of high pressure gas systems, but with the weight advantages of ammonia. Author

N70-34012*# Radio Corp. of America, Camden, N.J. Advanced Technology Labs.

ICICLE FEASIBILITY STUDY Final Report

Jul. 1970 300 p refs

(Contract NAS5-21039)

(NASA-CR-109880) Avail: CFSTI CSCL 21F

The following results were obtained through a feasibility study for an integrated cryogenic cooled isotope engine system: (1) infrared radiometric systems and laser or low noise microwave communications are required; (2) the use of a heat driven cryogenic refrigerator is feasible; (3) potential applications would range from 0.30 W to 7.00 W at temperatures of 60° to 120° K; (4) a

refrigerator delivering 5.0 W to 77°K requires 200 to 250 W of driving energy at 900° K; (5) a plutonium-238 fuel capsule can deliver the driving energy; (6) multifoil insulation is required for the hot end of the system; (7) sodium heat pipes are the preferred links between isotope and hot cyclinder; (8) ammonia heat pipes are preferred as heat sink for the pipe radiator; (9) cryogenic heat pipes are feasible for coupling between refrigerator and experiments; and (10) configuration of host spacecraft effects the final system configuration. Author

N70-34015*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TURBINE AERODYNAMIC AND COOLING REQUIREMENTS FOR A TURBOJET POWERED MACH 3 TRANSPORT USING METHANE FUEL

David G. Evans, Keith A. Furgalus, and Francis S. Stepka Washington Aug. 1970 80 p refs

(NASA-TN-D-5928; E-5602) Avail: CFSTI CSCL 21E

An analysis is presented of two-state air-cooled turbines designed for a series of afterburning and nonafterburning turbojet engines. The study considers the effects of turbine inlet temperature, takeoff jet noise, blade thermal cooling effectiveness, wall cooling, and precooling of the cooling air on turbine aerodynamic design and cooling airflow requirements. Blade and wall cooling requirements increased rapidly with increasing turbine inlet temperature. As a result, essentially no increase in turbine exit temperature or pressure was possible beyond a turbine inlet temperature of approximately 2500 F for the compressor pressure ratios, turbine metal temperatures, and turbine cooling methods considered. Author

N70-34162* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

GIMBALED, PARTIALLY SUBMERGED ROCKET NOZZLE Patent

Richard L. Brown, inventor (to NASA) Issued 28 Sep. 1965 (filed 4 Sep. 1964) 3 p Cl. 60-35.55

(NASA-Case-XMF-01544; US-Patent-3,208,215; US-Patent-Appl-SN-394638) Avail: US Patent Office CSCL 21H

A gimbaled nozzle concept for solid propellant rocket engines which eliminates any split along the internal surface of the nozzles is described for providing directional control. The nozzle entrance is partially submerged within the combustion chamber, which removes the juncture of the nozzle and the casing from the high velocity flow of the exhaust gases. R.B.

N70-34168*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEPOSITION OF ION THRUSTER EFFLUENTS ON SERT 2 SPACECRAFT SURFACES

John V. Staskus and Robert J. Burns 1970 15 p refs Proposed for presentation at 8th Elec. Propulsion Conf., Stanford, Calif., 31 Aug. - 2 Sep. 1970; sponsored by AIAA

(NASA-TM-X-52860; E-5805) Avail: CFSTI CSCL 21C

An experiment aboard the SERT II spacecraft to detect surface contamination by mercury ion thruster effluents is discussed. Two solar cell sensors were located adjacent to each thruster downstream from the exhaust plane. Sensor short circuit current was the contamination sensitive parameter. One sensor at +60°C was used for detection of sputtered thruster accelerator grid material (Mo), and the other sensor at −40° C was used for detection of propellant (Hg) in addition to molybdenum. Flight data indicates that contamination of both sensors was due to molybdenum. Contamination of the low temperature sensor by mercury was negligible. Radiation intensity transmitted by the contamination film was reduced to 50 percent of the incident intensity within 6 to 12 hr of thruster start-up. Author

N70-34175* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ELECTROTHERMAL ROCKETS HAVING IMPROVED HEAT EXCHANGERS Patent

Paul F. Brinich and John R. Jack, inventors (to NASA) Issued 12 Oct. 1965 (Filed 1 Oct. 1963) 4 p Cl. 60-35.5

(NASA-Case-XLE-01783; US-Patent-3,210,927; US-Patent-Appl-SN-313132) Avail: US Patent Office CSCL 21C

The heat exchanger used in the rockets is a high resistance device requiring smaller electrical currents and higher operating voltages which eliminate power losses outside the heater. The device utilizes a wire coil supported by perforated strips of electrical insulating material which also maintain the spacing between the individual coil turns. The insulator strips fit into slots in a heater core to accommodate a limited degree of motion caused by thermal expansion of the heater. R.B.

N70-34187*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

S-4B/5 AUXILIARY PROPULSION SYSTEM 90-DAY RECYCLE CAPABILITY TEST REPORT, MODULE 3, SUPPLEMENT 1

Jul. 1969 30 p Revised

(Contract NAS7-101)

(NASA-CR-109905; DAC-56758A) Avail: CFSTI CSCL 21H

The bladder examination included macroscopic and microscopic visual examination, photographs, and microtomed sections across the failure area. From these studies, and a comprehensive background of several past bladder failure and study analyses, the failure mechanism and probable cause were determined. The diffuser tube weld was examined, X-rayed, and the suspect area photographed under magnification. The implication that a weld projection punctured the bladder was not deemed likely after hardware examination; however, proof of the hypothesis was sought by testing an existing Model 8400 bladder assembly in a plexiglas tank shell. Author

N70-34224*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

LUNAR MODULE REACTION CONTROL SYSTEM ENGINE EXHAUST PLUME EVALUATION TEST IN THE SPACE ENVIRONMENT SIMULATION LABORATORY

15 Sep. 1969 68 p refs

(NASA-TM-X-64326; MSC-69-00153) Avail: CFSTI CSCL 21H

The configuration of the lunar module ascent and descent stages is such that the exhaust plumes from the ascent-stage downfiring reaction control system thrusters impinge on various parts of the spacecraft. The lunar module reaction control system plume-impingement test program was initiated to study the effects of the increased firing time on the structure of the lunar module. Included in the test evaluation were samples of the lunar module skins and insulation blankets, a lunar module landing window, a lunar module docking window, samples of the command module structure, and an ablative foam panel. The test was also planned to qualify an exhaust-plume deflector design. Author

N70-34294* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THRUST VECTOR CONTROL APPARATUS Patent

Earl W. Conrad, inventor (to NASA) Issued 12 May 1964 (Filed 27 Apr. 1961) 3 p Cl. 60-35.54

(NASA-Case-XLE-00208; US-Patent-3,132,476; US-Patent-Appl-SN-106135) Avail: US Patent Office CSCL 21H

A device is described for separating the rocket exhaust from the nozzle well to provide thrust vector control. Such control is accomplished by injecting a secondary fluid into the rocket nozzle flow field to separate the rocket exhaust flow, which produces a force perpendicular to the rocket thrust and provides the moment about the vehicle center of gravity. R.B.

N70-34530*# TRW Systems Group, Houston, Tex. Power Systems Dept.

APOLLO 9 LM-3 ASCENT PROPULSION SYSTEM, FINAL FLIGHT EVALUATION

P. F. Thompson and W. G. Griffin Jul. 1969 147 p refs
(Contract NAS9-8166)
(NASA-CR-109943; TRW-11176-H298-R0-00) Avail: CFSTI CSCL 21H

The ascent propulsion system was used for two firings: a 2.9 second firing while the ascent stage was manned and an unmanned firing to propellant depletion. The 2.9 second manned burn occurred at a ground elapsed time of 96:58:14 (hours:minutes:seconds) and the unmanned burn to propellant depletion began at 101:53:15.4. The lunar module was out of ground tracking station range during the first APS burn, therefore, no data from the burn were available. System pressures and temperatures were nominal when data was acquired after the burn. The second APS burn was initiated at 101:53:15.4 GET and the engine off signal was received at 101:59:17.7 GET, for a total duration of 362.3 seconds. The second APS burn was terminated by the planned oxidizer-first propellant depletion. The oxidizer depletion occurred approximately 3 seconds early based on reconstructed flight performance and low level sensor data. The time integrated average engine specific impulse and average engine mixture ratio determined by the burn to depletion (BTD) analysis were 309.7 seconds and 1.601 respectively. Analysis of the flight data also indicated that the APS engine throat erosion during the BTD was much greater than predicted. Author

N70-34604*# TRW Systems Group, Redondo Beach, Calif.
APOLLO 7 CSM 101 SERVICE PROPULSION SYSTEM, FLIGHT EVALUATION
11 Feb. 1969 46 p refs Sponsored by NASA
(NASA-CR-109929) Avail: CFSTI CSCL 21H

The performance of the spacecraft 101 service propulsion system during the Apollo 7 mission was evaluated and found to be satisfactory. The steady-state performance was determined by analyzing the fifth SPS burn using the Apollo propulsion analysis program. The propellant utilization and gaging system operated nominally during all burns, however, the fuel primary gaging system accuracy was less than anticipated. As planned, two oxidizer and two fuel point sensors were uncovered during the fifth burn. Two minimum impulse burns were performed satisfactorily, with the impulse from each burn comparing well with the present nominal performance. It is recommended that the present nominal minimum impulse performance data in the spacecraft operational data book be amended to include the statistical tolerances associated with that data. Author

N70-34606*# TRW Systems Group, Redondo Beach, Calif. Power Systems Dept.
APOLLO 10 LM-4 ASCENT PROPULSION SYSTEM, FINAL FLIGHT EVALUATION
W. G. Griffin 16 Sep. 1969 76 p refs
(Contract NAS9-8166)
(NASA-CR-109930; TRW-11176-H347-R0-00) Avail: CFSTI CSCL 21H

The duty cycle for the LM-4 ascent propulsion system consisted of two engine firings: a short manned burn and a longer unmanned burn to propellant depletion. APS performance for these two firings was evaluated and found to be satisfactory. Author

N70-34609*# Boeing Co., Houston, Tex. Space Div.
ENGINE RESTART AND THERMODYNAMIC ANALYSIS OF APOLLO SPACECRAFT ENGINE TESTS, VOLUME 1
B. F. Kerkam, A. A. Wood, M. G. Foley, and D. W. Smith [1969] 183 p refs
(Contract NASw-1650)
(NASA-CR-109945; D2-118246-1-Vol-1) Avail: CFSTI CSCL 21H

This report presents analyses of results obtained from cold flow and hot firing tests conducted on the LM ascent, LM descent, and service propulsion system engines. The purposes of these analyses were to provide a basis for defining the thermodynamic processes and hardware variables that lead to a hypergol engine hard restart after a short duration firing, and to determine if cold flow tests can be formulated to provide data that will allow a reduction in the requirements for costly hypergol engine hot firing restart performance tests. Engine restart characteristics were related to the results from thermodynamic analyses of propellant behavior during the coast phase of cold flow and hot firing tests. Hard restarts were related to the accumulation of frozen propellants in the injector assemblies and the accumulation of nitrates in the thrust chambers. Recommendations were made concerning the conduct of future cold flow test programs and for further experimental and analytical investigations. Author

N70-34610*# Boeing Co., Houston, Tex. Space Div.
ENGINE RESTART AND THERMODYNAMIC ANALYSIS OF APOLLO SPACECRAFT ENGINE TESTS, VOLUME 2
B. F. Kerkam, A. A. Wood, M. G. Foley, and D. W. Smith [1969] 133 p refs
(Contract NASw-1650)
(NASA-CR-109944; D2-118246-1-Vol-2) Avail: CFSTI CSCL 21H

This report presents analyses of results obtained from cold flow and hot firing tests conducted on the LM Ascent, LM Descent, and Service Propulsion System engines. The purposes of these analyses were to provide a basis for defining the thermodynamic processes and hardware variables that lead to a hypergol engine hard restart after a short duration firing, and to determine if cold flow tests can be formulated to provide data that will allow a reduction in the requirements for costly hypergol engine hot firing restart performance tests. Details of the test programs are covered in these appendices. Author

N70-34788* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INLET DEFLECTOR FOR JET ENGINES Patent
Walter T. Olson, inventor (to NASA) Issued 27 Jul. 1965 (filed 31 Oct. 1962) 4 p Cl. 55-306
(NASA-Case-XLE-00388; US-Patent-3,196,598; US-Patent-Appl-SN-234568) Avail: US Patent Office CSCL 21E

A deflector for obstructing the entry of birds and other foreign objects into aircraft jet engines during ground and flight operations is described. The deflector is composed of rods projecting forward in a conical shape, at an angle to the nacelle as axis, and with the base ahead of the inlet. The projected area is greater than the opening in the inlet and deflects objects out of the air stream as they approach the inlet. Air can pass between the deflector base and nacelle inlet even if a substantial portion of the deflector surface is momentarily covered with debris. N.E.N.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-33561# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. In Geophys., Astronomy, and Space, No. 227 30 Apr. 1970 p 46-67 (See N70-33556 18-34)
Avail: CFSTI

News releases concerning space research, and abstracts of published scientific articles are presented. Topics include Cosmos launchings, discussion of work in open space, ionospheric structure, spacecraft control, and cosmic radiation. F.O.S.

N70-33577# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 226 14 Apr. 1970 p 52 – 65 (See N70-33572 18-34)
Avail: CFSTI

Soviet news releases are presented on the Cosmos 326 launching, construction of a television satellite, ultrashort wave propagation, communications satellite and ground space communications, and interplanetary probes. An interaction is described between an artificial solar wind and a two dimensional magnet dipole. Abstracts are also included on various aerospace literature. J.A.M.

N70-34030# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
CORRELATION OF X-RAY RADIATION (2-12A) WITH MICROWAVE RADIATION. 10: 7 CM FROM THE NON-FLARING SUN Progress Report
Jean Gibson and James A. Van Allen Apr. 1970 41 p refs
(Contract N00014-68-A-0196-0003)
(AD-706072; Rept-70-5-Rev) Avail: CFSTI CSCL 3/2

The present paper uses (a) an extended, homogeneous body of solar X-ray observations (2 - 12 A) by University of Iowa equipment on the earth-orbiting satellite Explorer 33 and the moon-orbiting satellite Explorer 35 for 734 days during the period 1 July 1966 to 25 December 1968 and (b) the 10.7 cm (2800 MHz) daily solar radio flux values of the Algonquin Radio Observatory of the National Research Council of Canada. The specific purposes of the work are to establish the relationship between daily average values of the X-ray and radio fluxes from the whole disc of the non-flaring sun and to consider the significance of this relationship. TAB

N70-34042*# American Science and Engineering, Inc., Cambridge, Mass.
PRIME DATA REDUCTION AND ANALYSIS OF THE AS AND E OSO-4 POINTED AND WHEEL EXPERIMENTS Final Report
R. Giacconi, H. Gursky, A. Krieger, S. Naranan, F. Paolini et al
20 May 1970 177 p refs
(Contract NAS5-11106)
(NASA-CR-109862; ASE-2432) Avail: CFSTI CSCL 03B

The OSO-4 incidence X-ray telescope experiment studying the structure of solar X-ray sources in various bands and their relationship to solar physics is presented. Discussions are included on OSO-4 rotating wheel experiment for locating sources of soft X-rays in the celestial sphere and determining their intensities and spectral properties within several wavebands. The specifications of the X-ray telescope and detector package are described. Ground processing of telemetry data, calibration counting rate, true counting rate corrections, methods of approximation, and absolute flux calibration were calculated. Computer reduction and analysis routines are examined, emphasizing the Raster program. The OSO-4 data on X-ray emission, solar flares, and active regions are also analyzed. J.A.M.

N70-34222# Air Force Cambridge Research Labs., Bedford, Mass. Office of Aerospace Research.
THE MAGNETIC FIELD OF THE SOLAR PROMINENCE
V. A. Kotov Mar. 1970 11 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Krymskaya Astrofizicheskaya Observatoriya, Izv. (USSR), no. 69, 1969 p 276 – 278
(AD-705457; AFCRL-70-0193; AFCRL-Trans-71) Avail: CFSTI CSCL 3/2

Results are given of measurements of the longitudinal magnetic field in a prominence along the H alpha line; the measurements were made with the aid of the solar magnetograph of the Crimean Astrophysical Observatory. Author (TAB)

N70-34325# Air Force Cambridge Research Labs., Bedford, Mass.
THE TURBULENCE IN QUIESCENT PROMINENCES AND SHOCK WAVES IN THE UPPER ATMOSPHERE
E. E. Dubov Mar. 1970 14 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Krymskaya Astrofizicheskaya Observ., Izv. no. 69, 1969 p 295 – 298
(AD-705458; AFCRL-70-0194) Avail: CFSTI CSCL 3/2

It is shown that shock waves penetrating into a prominence may support the turbulence in quiescent prominences. Author (TAB)

N70-34379# Brookhaven National Lab., Upton, N.Y.
THE BROOKHAVEN SOLAR NEUTRINO EXPERIMENT Progress Report
Raymond Davis, Jr. 1969 7 p refs Presented at 11th Intern. Conf. on Cosmic Rays, Budapest, Sep. 1969 Sponsored by AEC
(BNL-14470; CONF-690814-11) Avail: CFSTI

The results of some experiments for a search for the neutrino radiation from the sun are described. Also discussed is the progress made toward increasing the sensitivity of the experiment. NSA

N70-34445*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC AND KINETIC PRESSURES IN THE SOLAR WIND
L. F. Burlaga and K. W. Ogilvie Jul. 1970 27 p refs Submitted for publication
(NASA-TM-X-63989; X-692-70-268) Avail: CFSTI CSCL 03B

Explorer 34 solar wind data for the period June to December, 1967 show that the magnetic pressure and kinetic pressure are variable and positively correlated on a scale of >2 days, but changes in magnetic and kinetic pressure are anticorrelated. Dynamical hydromagnetic processes must occur on the mesoscale, but the solar wind tends to be in equilibrium on a smaller scale, the microscale. The 3-hour averages show that the most probable value of the kinetic to magnetic pressure ratio is 1.0 + or − .1, which implies that the most probable state of the solar wind at 1 AU is not one of equipartition between the kinetic energy and magnetic energy. The average total pressure for a given bulk speed is essentially independent of V, implying that P is not determined by the heating or acceleration mechanisms of the solar wind; the average pressure is P = .29 + or − 1.5 nanodynes/sq cm. Author

N70-34746*# General Electric Co., Daytona Beach, Fla. Apollo Systems Dept.
THE PREDICTION OF SOLAR PARTICLE EVENTS: A SURVEY OF THE STATE-OF-THE-ART
William Atnell Feb. 1968 11 p refs Presented at the 5th Ann. AIAA Meeting, Philadelphia, 21-25 Oct. 1968 Sponsored by NASA
(NASA-CR-109958) Avail: CFSTI CSCL 03B

The current state-of-the art is reviewed in the prediction of solar particle events. A detailed review of the various prediction techniques and methods appearing in the literature is presented. Obvious limitations and shortcomings in the current methods exist. To date, no method exists to predict accurately the intensity and time of a solar particle event, mainly because of a lack of statistical data from previous events. Investigation of past weather records is recommended to study the possible correlation of past terrestrial weather conditions with solar particle events as a source of valid prediction data. Results of an initial look at this approach are presented. Author

N70-34767*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PRELIMINARY WARNING CRITERIA FOR THE SOLAR PARTICLE ALERT NETWORK
Manuel D. Lopez, Anna Lou Bragg, and Jerry L. Modisette 21 Jan. 1966 55 p refs Program Apollo Working Paper No. 1193

(NASA-TM-X-64400) Avail: CFSTI CSCL 03B

The Solar Particle Alert Network (SPAN) is being developed to provide the Apollo program with warnings of impending solar flare particle events, including estimates of their severity so that action can be taken to reduce the radiation dose received by the astronauts. SPAN consists of a network of solar radio and optical H alpha telescopes designed to observe phenomena associated with the acceleration of energetic solar particles. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-33455*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF SURVEYOR DATA, 1 JULY 1968–30 JUNE 1969
30 Jun 1969 180 p refs
(Contract NAS7-100)
(NASA-CR-109788; JPL-TR-32-1443) Avail: CFSTI CSCL 22A

CONTENTS:

1. REVISED LUNAR SURFACE TEMPERATURES AND THERMAL CHARACTERISTICS FROM SURVEYOR L. D. Stimpson, W. A. Hegemeyer, J. W. Lucas, Z. Popinski, and J. M. Saari (Boeing Sci. Res. Labs., Seattle) p 1–33 refs (See N70-33456 18-31)

2. LUNAR SOIL BULK DENSITY AS DETERMINED FROM SURVEYOR DATA AND LABORATORY TESTS R. Choate p 35–65 refs (See N70-33457 18-30)

3. LUNAR SOIL COEFFICIENT OF FRICTION DETERMINED FROM SURVEYOR DATA AND LABORATORY TESTS R. Choate p 67–99 refs (See N70-33458 18-30)

4. DEPTHS OF SURVEYOR FOOTPAD PENETRATIONS AT FIRST IMPACT: THEIR RELATION TO THE BEARING STRENGTH OF THE LUNAR SOIL R. Choate p 101–124 refs (See N70-33459 18-30)

5. OPTICAL SYSTEMS AND STATION PROCEDURES FOR THE SURVEYOR 7 LASER POINTING TEST M. S. Shumate p 125–134 refs (See N70-33460 18-16)

6. PHOTOMETRY AND POLARIMETRY J. J. Rennilson (Calif. Inst. of Tech., Pasadena) and H. H. Holt (Geol. Surv., Flagstaff, Ariz.) p 135–140 refs (See N70-33461 18-30)

7. LUNAR SOIL EROSION: SURVEYOR ATTITUDE CONTROL JETS E. M. Christensen and H. Y. Ko (Colorado Univ., Boulder) p 141–164 refs (See N70-33462 18-30)

8. COLORIMETRIC MEASUREMENTS OF THE SOLAR ECLIPSE AND EARTH FROM SURVEYOR 3 J. J. Rennilson p 165–175 refs (See N70-33463 18-30)

N70-33457*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR SOIL BULK DENSITY AS DETERMINED FROM SURVEYOR DATA AND LABORATORY TESTS
R. Choate *In its* Analysis of Surveyor Data 30 Jun. 1969 p 35–65 refs (See N70-33455 18-30)
Avail: CFSTI CSCL 22A

In study of Surveyor data during mission operations, it became apparent that many of the physical properties of the lunar soil were remarkably similar at the five Surveyor landing sites. One such physical property was that of bearing strength. On earth, the bearing strength of a soil is normally sensitive to changes in other interrelated physical properties, especially relative packing density, cohesion, and water content. A series of laboratory tests was conducted on simulated soils to more accurately evaluate several of these physical properties; namely soil bulk density or relative packing density, and the coefficient of friction. Using soils similar to lunar soil composition, particle size distribution, and cohesion as determined from the Surveyor mission, the bulk density and coefficient of friction were evaluated by reproducing soils with the same force vs penetration characteristics as demonstrated at the Surveyor landing sites. Author

N70-33458*# Jet Propulsion Labs., Calif. Inst. of Tech., Pasadena.
LUNAR SOIL COEFFICIENT OF FRICTION DETERMINED FROM SURVEYOR DATA AND LABORATORY TESTS
R. Choate *In its* Analysis of Surveyor Data 30 Jun. 1969 p 67–99 refs (See N70-33455 18-30)
Avail: CFSTI CSCL 22A

The lunar soil coefficient of friction was estimated on the basis of 70 laboratory tests of three basalt soils at various densities ranging from dense to loose packing. Selection of coefficient of friction values that best represent lunar soil incorporates knowledge obtained in soil cohesion, particle size distribution, and bearing strength measurements obtained at five Surveyor landing sites. The best fit to Surveyor data provides a coefficient of friction for lunar soil of 0.35 at initial displacement, 0.72 at 2.5 cm displacement, 0.89 at 7.6 cm displacement, and 0.95 at 15.2 cm displacement. The laboratory test values agree with the estimates made directly from Surveyor 5 data, which were 0.73 for sliding of the spacecraft, and between 0.84 and 1.10 for sliding of the sensor head of the alpha scattering instrument when the vernier engines were fired. Author

N70-33459*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEPTHS OF SURVEYOR FOOTPAD PENETRATIONS AT FIRST IMPACT: THEIR RELATION TO THE BEARING STRENGTH OF THE LUNAR SOIL
R. Choate *In its* Analysis of Surveyor Data 30 Jun. 1969 p 101–124 refs (See N70-33455 18-30)
Avail: CFSTI CSCL 22A

Knowledge of the bearing strength of the lunar surface is essential for economic design of spacecraft landing gear, design of roving vehicles, and planning of energy expenditure for manned or unmanned lunar surface traverses. Determination of the lunar surface bearing strength requires accurate measurements of the force exerted by the penetrating object and of the depth of penetration. The depth of penetration measurements made by foot-pads and crushable blocks in seven touchdowns of five Surveyor spacecraft are presented. The bearing strength values determined from these penetration measurements are included. Author

N70-33461* California Inst. of Tech., Pasadena.
PHOTOMETRY AND POLARIMETRY OF THE EARTH
J. J. Rennilson and H. H. Holt (Geol. Surv., Flagstaff, Ariz.) *In* JPL Analysis of Surveyor Data 30 Jun. 1969 p 135–140 refs Prepared in cooperation with Geol. Surv., Flagstaff, Ariz. (See N70-33455 18-30)
Avail: CFSTI CSCL 03B

During the Surveyor 7 mission, the earth was observed by the television cameras of the spacecraft to measure the average luminance of the earth over as great a range of phase angles as possible and to measure the degree and orientation of the polarization of light reflected from the earth. The measurements show that the earth reflectance is higher than expected from astronomical data and specular reflection of sunlight from the ocean areas show large amounts of polarization. A possible correlation exists between the degree of polarization and the sea state of the ocean. Author

N70-33462*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR SOIL EROSION: SURVEYOR ATTITUDE CONTROL JETS

E. M. Caristensen and H. Y. Ko (Colorado Univ., Boulder) *In its* Analysis of Surveyor Data 30 Jun. 1969 p 141–164 refs (See N70-33455 18-30)
Avail: CFSTI CSCL 22A

The pressure characteristics of the exhaust plume of a Surveyor attitude control jet impinging on an instrumented surface and the effects of the plume impinging on soil surfaces were studied under different laboratory vacuum environments. The values of cohesion obtained in the laboratory fall within the estimated range for lunar soil cohesion obtained by using other sources of Surveyor data such as the soil mechanics surface sampler and vernier engine soil erosion. Author

N70-33463*# California Inst. of Tech., Pasadena.
COLORIMETRIC MEASUREMENTS OF THE SOLAR ECLIPSE AND EARTH FROM SURVEYOR 3
J. J. Rennilson *In* Analysis of Surveyor Data 30 Jun. 1969 p 165–175 refs (See N70-33455 18-30)
Avail: CFSTI CSCL 03B

The solar eclipse began at 09:48 GMT on April 24, 1967. Shortly after the start of the eclipse, the camera was commanded to its highest elevation step, to the wide-angle mode, and to photograph two sets of pictures. Later in the mission, the camera was pointed to its upper elevation limit and was commanded to photograph the earth in its crescent phase. On each of these series, the filter wheel containing color filters was cycled. The colors of the eclipse show blue attenuation as the sunlight is refracted through the atmosphere. The colors, especially in the clear areas of the atmosphere, also increase in purity as the angular separation increases between these areas and the sun. The average earth chromaticity, determined largely by cloud cover, agrees well with that of extraterrestrail sunlight. Author

N70-33502# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, no. 229 26 May 1970 p 1–6 refs (See N70-33501 18-34)
Avail: CFSTI

Summaries are presented on astronomical research, including the Churyumov-Gerasimenko comet 1969h, measurements of Saturn's rings, mascons of lunar maria, the nature of lunar seismic echoes, a new coronagraph at Pulkovo, spectrophotometric study of the Honda comet 1968c, pulsations of pulsar CP 0808, and the parameters of the interplanetary field from the anisotropic state in cosmic ray bursts. R.B.

N70-33542# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
ANALYTICAL LUNAR EPHEMERIS. 1: DEFINITION OF THE MAIN PROBLEM
Andre Deprit, Jacques Henrard, and Arnold Rom Mar. 1970 30 p refs Its Math. Note 647
(AD-705641; D1-82-0963) Avail: CFSTI CSCL 3/1

A new set of phase variables is proposed and justified to develop automatically by computer the solar terms in Lunar Theory. The dependence of the perturbation function on the mass ratio Moon/(Earth + Moon) is completely elucidated. A recursive procedure is proposed to develop that function so as to keep explicit all its d'Alembert characteristics. The perturbation series obtained by computer is compared with Delaunay's development. Author (TAB)

N70-33557# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy and Space, No. 227 30 Apr. 1970 p 1–8 (See N70-33556 18-34)
Avail: CFSTI

Summaries of recent published articles of the USSR on astronomy are presented. Included topics are solar radiation, solar neutrino detectors, and planetary observations. F.O.S.

N70-33573# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space; No. 226 14 Apr. 1970 p 1–13 (See N70-33572 18-34)
Avail: CFSTI

The possible events leading up to the beginnings of life on earth are discussed, with emphasis on the development of RNA and DNA. An updated review is presented on Venus using recent astronomical observations, theoretical research, and space exploration. The specifications and performance of the 70 cm telescope in Tadzhikistan are described. Abstracts are also included on astronomical literature. J.A.M.

N70-33628 Kodaikanal Observatory (India).
LINE PROFILE ANALYSIS OF CARBON MOLECULES IN THE SUN
Nirupama Raghavan Sep. 1968 27 p refs
(Bull-A-186) Copyright. Avail: Issuing Activity

Thirteen molecular lines of CN, C2 and CH were photoelectrically observed at six disc positions each. The observed trends fall into two categories; one for strong lines and another for weak lines, irrespective of the molecule of their origin. Detailed profile calculations were made for six selected lines. LTE methodology and an anisotropic model of turbulence were assumed. In the region of line formation for these molecules (tau = 0.1 to 0.04) Xi sub rad, and Xi sub tan are 3.0 km/sec and 3.6 km/sec respectively. An interesting variation of the factor F, used for fitting central intensities with mu is found. It is strongly suspected that important physical reasons underlie this variation. Author

N70-33750*# Cornell Univ., Ithica, N.Y. Center for Radiophysics and Space Research.
THE 1969 OPPOSITION EFFECT OF MARS: FULL DISC, SYRTIS MAJOR AND ARABIA
Brian O'Leary and Lawrence Jackel Jun. 1970 36 p refs
(Contract NAS9-8018)
(NASA-CR-108491; CRSR-386) Avail: CFSTI CSCL 03B

Photometry of the full disc of Mars confirms the existence of a moderate opposition effect, i.e. a non-linear surge in brightness toward zero phase. Observations of small areas on the disc suggest a very strong opposition effect for Syrtis Major; the extent is somewhat similar to the lunar case. Also confirmed is a 13% absorption feature near 1.0 micron in the ratio spectrum Syrtis Major/Arabia. The color of Syrtis Major/Arabia appears to have changed from previous observations such that the brightness contrast is greater in the red and near-infrared than at shorter wavelengths. Author

N70-33806*# Consultants in Electrodynamics, Oak Park, Ill.
A STUDY OF PULSE PROPAGATION OF ELECTROMAGNETIC SIGNALS THROUGH THE SOLAR CORONA
C. M. Knop, Y. Shiau, and V. Gylys Washington NASA Jul. 1970 205 p refs
(Contract NAS1-9142)
(NASA-CR-1572) Avail: CFSTI CSCL 20N

The basis of a small solar probe propagation experiment to measure the radial variation of electron density in the solar corona is reviewed. Although a concise review of the entire scheme is given, emphasis is placed on a rigorous formulation of the dispersion undergone by a stepped carrier wave and a coded group

of such waves. It is shown that the electron density can be determined by use of a cross-correlation receiver, either to measure the shape of the correlation response at a single carrier frequency or, alternatively, by using several coded carriers at sufficient separation times, and measuring the time difference between the peaks of the corresponding correlation responses. It is shown that the received correlation functions are characterized by a single solar distortion parameter which is the ratio of the rise time of the envelope of a single stepped carrier to the square root of 2 times the bit length. Author

N70-33865*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
RADAR EXPLORATION OF VENUS
D. L. Roberts and H. L. Goldman Jun. 1970 23 p
(Contract NASw-2023)
(NASA-CR-109792; IITRI-TM-S-7) Avail: CFSTI CSCL 03B

Broad questions of exploration of the Venus surface using radar are treated and an attempt is made to place in perspective the different modes of radar operation, to compare their respective contributions, and to identify their major system requirements. Emphasis is placed on defining a set of radar experiments compatible with the planetary explorer spacecraft. Problem areas that exist in defining the radar exploration of Venus are analyzed experiments to resolve those problems are proposed. D.L.G.

N70-33867*# IIT Research Inst., Chicago, Ill.
LONG RANGE PLANNING FOR SOLAR SYSTEM EXPLORATION Semi-annual Report
May 1970 May 1970
(Contract NASw-2023)
(NASA-CR-109791; IITRI-V6105) Avail: CFSTI CSCL 22A

A preliminary understanding of candidate missions and associated requirements which bear on the long range exploration of the solar system is presented. The level of effort, in man-months, is shown at monthly intervals for each study task. The Comet Rendezvous Opportunities, Jupiter Orbiter Mission, and Spacecraft Radar Studies are continued tasks. The analyses and results obtained are described in the individual task subsections. Author

N70-33879*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO LUNAR DESCENT AND ASCENT TRAJECTORIES
Floyd V. Bennett Mar. 1970 33 p refs Presented at AIAA 8th Aerospace Sci. Meeting, New York, 19-21 Jan. 1970
(NASA-TM-X-58040) Avail: CFSTI CSCL 22C

A description of the premission planning, real-time situation, and postflight analysis for the lunar descent and ascent phases of the Apollo 11 mission, the first manned lunar landing, is given. Actual flight results are shown to be in agreement with premission planning. Based on Apollo 11 postflight analysis, a navigation correction capability was provided for Apollo 12. A preliminary postflight summary of the descent for Apollo 12, the first pinpoint landing, is also included. Author

N70-33932*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CATALOGUE OF DATA IN WORLD DATA CENTER A: ROCKETS AND SATELLITES, 1 JANUARY – 30 JUNE 1969
Jul. 1969 35 p refs
(NASA-TM-X-64291) Avail: CFSTI

Sounding rocket launchings, launching sites, and meteorological sounding rocket data are listed. Reports and reprints are included ranging from ionospheric physics to biology and from instrumentation and data recovery to electromagnetic radiation. Artificial earth satellite and space probe launchings are also tabulated. J.A.M.

N70-33940*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
UNIFIED THEORY OF THE INTERPLANETARY MAGNETIC FIELD
Ronald L. Rosenberg 5 Jun. 1970 19 p refs
(Grant NGL-05-007-065)
(NASA-CR-109868; Publ-847) Avail: CFSTI CSCL 03B

A simple model is used to present the polarity pattern of the interplanetary magnetic field observed during the solar cycle. The heliographic latitude dependence of the dominant polarity of the interplanetary magnetic field is explained in terms of weak poloidal (dipolar) field sources in the sun's photosphere. It is hypothesized that the dipolar field exists at equatorial latitudes and that the major source of the interplanetary magnetic field observed near the ecliptic plane is the dipolar field from equatorial latitudes. The effect on the solar wind of the greater activity in the northern hemisphere of the sun that existed in 1968 and 1969 is believed responsible for this hypothesized depression, especially near solar maximum, of the plane separating the positive and negative dipolar polarity below the solar equatorial plane in space. Predictions are made concerning the interplanetary field to be observed near the ecliptic plane in each portion of the next solar cycle. Author

N70-33953*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCIENTIFIC OBJECTIVES FOR IMAGING EXPERIMENTS AT THE OUTER PLANETS
T. H. Reilly 15 Jun. 1970 13 p refs
(Contract NAS7-100)
(NASA-CR-109871; JPL-TM-33-454) Avail: CFSTI CSCL 22A

Scientific objectives for imaging experiments on a fly-by of the outer planets are outlined. Jupiter, Saturn, Uranus, Neptune, and Pluto. Imaging experiments are proposed in atmospheres, satellites and rings, planetary figures, the surface of Pluto, and the asteroid belt. An attempt is made to demonstrate how the proposed experiments would close gaps in our current knowledge of the outer planets. Some functional requirements such as resolution and spectral bandwidth of the imaging system were identified. Author

N70-33960*# ITT Research Inst., Chicago, Ill. Technology Center.
COMPOSITIONAL ANALYSIS OF LUNAR AND PLANETARY SURFACES USING NEUTRON CAPTURE GAMMA RAYS, 1 OCTOBER – 31 DECEMBER 1969
John H. Reed and John W. Mandler Jan. 1970 24 p refs
(Contract NASr-65(18))
(NASA-CR-109861; IITRI-V6032-15) Avail: CFSTI CSCL 03B

Continuing research in the development of the Combined Pulsed Neutron Experiment (CPNE) for lunar and planetary surface analysis is reported. The major effort was aimed at two specific tasks: (1) the development of computer techniques for the analysis of the data; and (2) studies which will aid in the determination of the final experimental parameters such as pulse rate and sampling times. A simulated capture gamma-ray spectrum of a moon rock returned from the Apollo 11 landing was generated (assuming laboratory conditions and a small sample) and analyzed using ALPHA-M. Investigations were initiated to simulate the capture gamma-ray plus activation spectra obtained from basalt, dunite, and granite using the combined neutron experiment. The TIME computer code was modified so that it could perform parametric studies to optimize the pulse rate. Author

N70-33985*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
[MINIMUM IMPULSE TRANSFER FROM CIRCULAR ORBITS] Quarterly Progress Report
19 May 1970 69 p
(Contract NAS9-10388)
(NASA-CR-108509; MIT-70-412L-1) Avail: CFSTI CSCL 22C

An approximate analytical solution is obtained for minimum impulse transfer between a given circular orbit and a given hyperbolic velocity vector at infinity. The transfer time between the first and last impulses is assumed fixed and much larger than the period of the circular orbit. A minimum allowable periapsis radius is prescribed. The solution is developed as the initial terms in an asymptotic expansion in inverse powers of the transfer time. Below a critical inclination the optimal solution requires three impulses, while above this inclination four impulses are required. E.M.C.

N70-33990*# Rensselaer Polytechnic Inst., Troy, N.Y.
TERRAIN MODELING AND PATH SELECTION BY AN AUTONOMOUS MARTIAN EXPLORATORY VEHICLE
C. Pavarini and J. H. Chrysler, Jr. Jun. 1970 77 p refs
(Grant NGL-33-018-091)
(NASA-CR-109797; RPI-MP-14) Avail: CFSTI CSCL 22A

The problem considered was the development of the capability of an unmanned Martian exploratory vehicle to safety rove on the surface of the planet. The problem of sensing and modeling the terrain was studied in light of sensor capabilities and data processing methods necessary to obtain an accurate approximation to the actual terrain. Improvements were made upon a previously developed modeling technique and computer simulations were carried out on several arbitrary terrains to determine its accuracy. Methods for the evaluation of path-selection algorithms were developed and demonstrated. Heavy consideration was given to the characteristics of the vehicle and the attaining of mission goals. A path-selection algorithm which takes into account energy requirements in addition to terrain passability and target direction was written. A total package, incorporating the terrain modeling and path selection procedures, was shown to be feasible by computer simulation. Author

N70-33993*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPERATION PROFILES FOR LUNAR ROVING MISSIONS
C. W. Mc Cormick May 1970 77 p refs
(Contract NAS7-100)
(NASA-CR-109800; JPL-760-16) Avail: CFSTI CSCL 22A

This report describes preliminary analyses of: (1) the sequence of operations needed to execute those individual elemental tasks which, in recurrent combination, form the operational profile of lunar roving vehicle mission; and (2) the functional requirements which such elemental tasks impose upon the mission operations complex. Author

N70-34009*# Lamont Geological Observatory, Palisades, N.Y.
LUNAR SCIENCE PRIOR TO APOLLO 11
Robert Jastrow (NASA. Goddard Space Flight Center), Vivien Gornitz (NASA. Goddard Space Flight Center), Paul W. Gast, and Robert A. Phinney (Princeton Univ.) Greenbelt, Md. NASA 10 Sep. 1969 43 p refs
(Grant NGR-33-008-107)
(NASA-CR-109882) Avail: CFSTI CSCL 03B

Part I of the present report has been prepared in lieu of a conference summary. Part II consists of papers containing observational lunar evidence and theoretical interpretations, offered as a representative selection rather than a complete bibliography. The selection includes descriptive accounts written in general language as well as papers from the technical literature. Author

N70-34062*# Lowell Observatory, Flagstaff, Ariz. Planetary Research Center.
MARTIAN POLAR CAP BOUNDARIES, PART A Final Report
G. E. Fischbacher, L. J. Martin, and W. A. Baum May 1969 61 p Prepared for JPL
(Contracts NAS7-100 JPL-951547)
(NASA-CR-109852; Rept-69-335) Avail: CFSTI CSCL 03B

The boundaries of the north and south polar caps of Mars were measured on more than 3,000 yellow and red photographs from the Lowell Observatory plate collection. These photographs, obtained between 1905 and 1965, included a good sampling of all Martian seasons. The boundaries of the caps were read at intervals of 10 deg in longitude on the Martian surface, and the data were averaged over time intervals equal to 1/36 of the Martian year. Readings were entered directly onto IBM cards by the mark-sense method, and computer programs were written to organize the results into the form of tabulations and plots. Each of the polar caps is most favorably situated for measurement during the season when it is receding. After an initially erratic start, the melt phase of each cap was found to follow a well-defined curve that repeated itself very closely from one Martian year to another. During the melt phase, the mean deviations of measurements from various plates were only about 1 deg, and the variation from one Martian year to another was of similar magnitude. Author

N70-34063*# Lowell Observatory, Flagstaff, Ariz. Planetary Research Center.
A STUDY OF CLOUD MOTIONS ON MARS, PART B Final Report
L. J. Martin and W. A. Baum Aug. 1969 56 p Prepared for JPL
(Contracts NAS7-100; JPL-951547)
(NASA-CR-109853; Rept-69-336) Avail: CFSTI CSCL 03B

A search of 5,000 Mars plates in the Lowell Observatory collection yielded 28 groups of plates on which the local positions of well-defined bright clouds or cloud groups could be followed on a daily basis. These groups of plates were from fifteen different oppositions of Mars, starting from 1907 and ending with 1958. Each group of plates covered a time period of at least two days and up to 29 days. The position and extent of all associated clouds (whether appearing to show motion or not) were plotted on Mercator projections with the help of a projection plate reader especially designed for planet image studies of this kind. The 28 groups of plates yielded 95 cloud histories. More than half appeared to be relatively stationary and sometimes recurrent. Others show definite motion well in excess of observational errors, but sometimes follow paths that partly double back upon themselves. The mean velocity for non-stationary clouds was found to be 5.6 kilometers per hours, and the most commonly occurring direction was eastward, particularly at high latitudes. Author

N70-34081# Air Force Cambridge Research Labs., Bedford, Mass.
MEASUREMENT AND INTERPRETATION OF THE SPECTRA OF CERTAIN DISCRETE RADIO SOURCES IN THE 20-40 MHz RANGE
Donald A. Guidice Mar. 1970 55 p refs
(AD-705185; AFCRL-70-0145; AFCRL-PSRP-412) Avail: CFSTI CSCL 3/2

An investigation of certain discrete radio sources, including the experimental measurement of their flux densities and a theoretical interpretation of their spectra, has been carried out for the 20-40 MHz frequency range. The observations were made at 22.30, 26.70, 33.45 and 38.75 MHz using the 1000-ft radio telescope of the Arecibo Ionospheric Observatory. Descriptions of the observations and the data analysis are given, together with a discussion of the limitations imposed on the measurements by the ionosphere and the radio telescope. The flux densities of eight discrete radio sources at the four operating frequencies, measured relative to Taurus A, are presented. A detailed error analysis was carried out; anticipated errors are given for each flux density value. Author (TAB)

N70-34101*# Scientific Translation Service, Santa Barbara, Calif.
FOUR UNRESOLVED PROBLEMS OF PLANETARY COSMOGONY [CHETYRE NERESHENNYYE PROBLEMY PLANETNOY KOSMOGONII]
B. Yu. Levin Washington NASA Jul. 1970 29 p refs Transl. into ENGLISH from Priroda (Moscow), no. 6, 1969 p 22–34

(Contract NASw-2035)
(NASA-TT-F-13037) Avail: CFSTI CSCL 03B

The four unsolved problems are: the origin of the Earth's photoplanetary cloud, the condensation of matter in the cloud and fractionation of iron, the accumulation of the major planets and the differentiation of the Moon. Author

N70-34125# Newcastle Univ. (Australia).
THE WORK AT CHRISTCHURCH, NEW ZEALAND
Clifton D. Ellyett *In* AFCRL Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 263–269 (See N70-34106 18-20)
Avail: CFSTI

Meteor rate measurements taken at Christchurch, New Zealand, and Newcastle, Australia, are briefly described, and applications in wind measurements are mentioned. A large increase in rates was found at the peak of Delta Aquarids in 1963 and 1965, and mean hourly rates of meteor radar echoes are presented. N.E.N.

N70-34130# Air Force Cambridge Research Labs., Bedford, Mass.
DISCUSSION OF JOINT PROGRAM FOR GEMINIDS
In its Proc. of the Workshop on Methods of Obtaining Winds and Densities from Radar Meteor Trail Returns Apr. 1968 p 289–291 (See N70-34106 18-20)
Avail: CFSTI

The joint program for observing Geminids is mentioned, and information on the direction and dates most suitable for the observations are given. N.E.N.

N70-34165*# National Aeronautics and Space Adminstration. Ames Research Center, Moffett Field, Calif.
THE USE OF LUNAR BEACONS IN LUNAR ORBIT ESTIMATION
Thomas M. Carson Washington Aug. 1970 50 p refs
(NASA-TN-D-5912; A-3521) Avail: CFSTI CSCL 22C

Kalman filtering techniques were applied in evaluating the use of lunar beacons in estimating the state of a lunar vehicle. Range and/or range-rate measurements were used as the observational data. Results show that the error in the beacon location can be reduced from an initial error of 1.73 kilometers to approximately 0.2 kilometer, by the use of earth-based observations. The use of on-board observations of the lunar beacons can contribute significantly to lunar orbit estimation when used in conjunction with earth-based observations. Locating the beacons to provide state information that was difficult to obtain from earth-based measurements proved beneficial. On-board observations also proved adequate in estimating the state of a lunar vehicle when they were the only data source available. Author

N70-34206# Princeton Univ., N.J.
RESEARCH IN THE ASTROPHYSICAL SCIENCES Final Technical Report, 1 Mar. 1965–28 Feb. 1970
Melvin B. Gottlieb and Lyman Spitzer, Jr. 9 Apr. 1970 16 p refs
(Contract AF 49(638)-1555)
(AD-705238; AFOSR-70-1043TR) Avail: CFSTI CSCL 3/2

The report describes research under the contract in the following 7 areas: The study of the plasma state of matter from a statistical mechanical point of view, i.e., the general many-body problem, and problems involving collective behavior; Basic studies in plasma regime where plasma and quantum mechanical effects overlap; Investigation of phenomena associated with the quantum nature of plasmas in the solid state; The interplanetary plasma and geophysical problems associated with the interactions of the solar wind and the earths magnetosphere; Interpretation of observed spectra and dynamical processes in the solar and stellar atmospheres; Study of the detailed nucleogenesis in a star including the effect of rotation and magnetic fields; and Analysis of the equilibrium and physical phenomena in the interstellar gas. TAB

N70-34219*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SOME REDESIGNATION CHARACTERISTICS ATTRIBUTED TO SLOWING THE LM LANDING APPROACH TRAJECTORY
Thomas E. Moore 30 May 1969 9 p refs
(NASA-TM-X-64306; MSC-69-EG-22) Avail: CFSTI CSCL 22C

The slowdown of the operational trajectory has greatly affected the redesignation characteristics of the LM. The major effects are shown to be a forty percent reduction in redesignation delta V-footprint and a reduction by at least a factor of five of the maximum downrange capability due to resulting trajectory shallowness. The possibility of eliminating these undesirable redesignation characteristics with a software change (delta guidance) is demonstrated. Author

N70-34242*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
PRECISION TARGETING FOR MULTIPLE SWINGBY INTERPLANETARY TRAJECTORIES
Stephen S. Bayliss (Ph.D. Thesis) Jun. 1970 193 p refs
(Grant NGR-22-009-207)
(NASA-CR-109936; TE-39) Avail: CFSTI CSCL 22C

The gap between a simple conic model and an integrated N-body trajectory is bridged in two steps. The first of these utilizes a model of the trajectory consisting of alternating planetocentric and heliocentric conic legs corresponding to trajectory segments inside and outside of the planetary spheres of influence. The trajectory legs are constrained to match in position and time but are initially mismatched in velocity. An iteration scheme is developed to drive this mis-match to zero. As the second step, N-body perturbed trajectories are calculated which have the same end conditions in position and time as the conic legs in the previous step but have slight offsets in initial and final velocities. The same iteration scheme utilized in the first step is employed to match these perturbed segments in velocity as well as position and time. Finally, the accuracy of each trajectory leg is checked by numerical integration. Three examples are considered in detail. They are: (1) a dual planet reconnaissance trajectory (Earth-Venus-Mars-Earth); (2) grand tour trajectory (Earth-Jupiter-Saturn-Uranus-Neptune); and (3) periodic trajectory (a repeating Earth-Venus shuttle trajectory). Author

N70-34273*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ENVIRONMENTAL FACTORS INVOLVED IN THE CHOICE OF LUNAR OPERATIONAL DATES AND THE CHOICE OF LUNAR LANDING SITES
22 Nov. 1963 94 p refs Program Apollo Working Paper No. 1100
(NASA-TM-X-64294) Avail: CFSTI CSCL 22A

Environmental factors that may influence the choice of Apollo operational launch dates are covered and recommendations made on the basis of the present state of knowledge. The present state of knowledge of large scale topography of the lunar surface is briefly reviewed and the best estimate of small scale topography given. Based on criteria for selection, ten lunar landing areas are recommended as most likely to contain acceptable landing sites. A sufficient aprreciation of most of the environmental factors is provided which will effect the operational planning of Apollo missions. Author

N70-34274# Arizona Univ., Tucson.
SKY SURVEY Semiannual Technical Report
Frank J. Low 15 Mar. 1970 17 p refs
(Contract F19628-70-C-0046)
(AD-705597; AFCRL-70-0179; SATR-1) Avail: CFSTI CSCL 3/2

Results of a preliminary survey of 2 percent of the sky at a 5 arc minute beam at a wavelength of 5 microns are presented. Photometric observations of stars, infrared stars, infrared

nubulae, infrared galaxies, and the planets have been made at effective wavelengths of 5, 10 and 22 microns. These data are summarized in tabulated form with references where necessary. Using the absolute flux calibration of the zero point on each of the three magnitude systems, M (5 microns), N (10 microns) and Q (22 microns), it is possible to convert the observed magnitude to absolute fluxes. This body of data serves to describe the appearance of the sky at infrared wavelengths. Author (TAB)

N70-34317*# GCA Technology Div., GCA Corp., Bedford, Mass.
PLANETARY METEOROLOGY Quarterly Progress Report, 1 Jan. - 31 Mar. 1970
George Ohring and Tom Degges 31 Mar. 1970 37 p refs
(Contract NASw-1725)
(NASA-CR-109793; QPR-8) Avail: CFSTI CSCL 03B

The thermal equilibrium model was applied to the problem of estimating the latitudinal variation of the atmospheric temperature profile on Venus. Calculations of temperature were performed for a model atmosphere consisting of pure CO2 with a trace, .001, of water vapor, and a surface pressure of 65 atm. The results indicate a variation of surface temperature from 765 K at the equator to 475 K at 80 deg latitude. The thermal equilibrium model was also used to evaluate the sensitivity of computed Venusian surface temperature to assumed surface pressure. The results indicate that, with the assumed model atmosphere, the mean surface temperature would vary from 490 K to 775 K as the surface pressure changes from 10 atm to 100 atm. Some preliminary analyses were performed on Venusian cloud composition. Information on atmospheric composition, water vapor content, and temperature structure were reviewed. A preliminary assessment, based upon the microwave observations and theory, and the space-probe observations, indicates that H2O clouds are possible if the H2O content on Venus is similar to that given by the Soviet spaceprobe observations. Author

N70-34361*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INTERPOLATION OF BODE'S TABLE OF THE SOLAR CONTINUOUS ABSORPTION COEFFICIENT
Edward M. Wadsworth 1 Jul. 1970 15 p refs
(NASA-TM-X-64534) Avail: CFSTI CSCL 03B

Bode has compiled a set of tables for the continuous absorption coefficient for the sun covering a wide range of wavelengths, electron pressures, and temperatures. To obtain the absorption coefficient as a function of electron pressure and temperature at an untabulated wavelength, standard interpolation formulas are employed using the several wavelengths listed, which are between major absorption edges and span the desired wavelength. At a given wavelength the absorption coefficients at particular temperatures and pressures not given in the table can be obtained by a double linear interpolation scheme. A computer subprogram is described which has been developed to calculate the solar continuous absorption coefficient for any given model atmosphere. Author

N70-34363*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A PARAMETRIC STUDY OF CENTRAL ANGLE OF TRAVEL AND TIME FOR REENTRY FROM NEAR-EARTH ORBITS
William R. Pruett 12 Aug. 1966 145 p refs
(NASA-TM-X-64323; MSC-66-FM-79) Avail: CFSTI CSCL 22C

Graphs are presented for the orbit-referenced central angle of travel from retrofire to 400,000 ft and the time from retrofire to 400,000 ft as functions of true anomaly of retrofire. The curves are not extremely smooth because the true anomaly increment used was ten degrees and errors existed because of the program's characteristics. Pitch angles of 0, 20, 40, 60, 80, and 90 degrees, and retrograde Delta V's of 100, 300, 500, and 700 fps were used. Author

N70-34367*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
METHODS FOR DETERMINING THE ORBITAL TRANSFER REQUIREMENTS FOR NEAR-EARTH ORBITS
Samuel L. Miller and David J. Griffith 30 Jan. 1968 72 p
(NASA-TM-X-64296; MSC-68-FM-25) Avail: CFSTI CSCL 22C

In the process of defining the Apollo C mission, in which the rendezvous maneuvers and the duration of SPS burns are subject ot change, a method was required that quickly and accurately estimates the changed maneuvers. The material presented provides both a graphical and an analytical method for estimating the delta V requirements for the orbital transfer maneuvers. With the exception of those for the rendezvous, the parametric data can be used to determine the orbital maneuver requirements. Use of both methods indicates that either gives comparatively accurate external delta V components. Author

N70-34372*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
COORDINATE SYSTEM INFLUENCE ON THE REGULARIZED TRAJECTORY OPTIMIZATION PROBLEM
J. M. Lewallen and O. A. Schwausch (Lockheed Electron. Co.) Mar. 1969 86 p refs
(NASA-TM-X-64297; MSC-ED-IN-68-79) Avail: CFSTI CSCL 22C

The effect of using regularized variables to enhance the numerical integration process associated with the optimal trajectory of a continuously thrusting space vehicle is analyzed. The integration characteristics of both the rectangular cartesian and polar cylindrical coordinates are considered for an optimal, low-thrust, earth-escape, spiral trajectory. The numerical accuracy achieved and the computer time required are compared for various numerical integration error bounds, by using both the unregularized and regularized equations. The results indicate that for space vehicles which experience wide variations in the gravitational force magnitude, significant reductions in computing time can be obtained by using the regularized trajectory optimization equations. In some cases, the computing time is reduced by a factor of three if regularized variables are used. Author

N70-34390*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
MIXED PROPULSION MODE ORBITAL TRANSFERS
C. Julian Vahlberg, Jr. (Ph.D. Thesis) Jun. 1970 195 p refs
(Grant NGR 22-009-010)
(NASA-CR-109938; MIT-TE-40) Avail: CFSTI CSCL 22C

Transfers between coplanar coaxial ellipses in a strong inverse square gravitational field are investigated. The control acceleration is provided by a combination of ideal velocity limited and ideal power limited rockets. The velocity limited rocket is assumed capable of impulsive thrust. The combination of impulsive with continuous control accelerations introduces complexities in the optimal control problem which are not present in the independent study of either one. A general cost function for ideal engines and necessary conditions for transfers in an arbitrary gravitational field are derived in a form for application to orbital transfers. The solutions for field free space transfers are given. The necessary conditions for optimal transfers between coplanar coaxial elliptic orbits are derived and then solved on a digital computer. The number and timing of impulses are numerically determined. A substantial improvement in payload is obtained by the optimum combination of propulsion systems. Author

N70-34397*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BLOCK AND STRIP SOLUTIONS INVOLVING LUNAR ORBITER PHOTOGRAPHIC DATA USED TO PREPARE CONTOUR CHARTS FOR FIVE APOLLO LANDING SITES
Ruben L. Jones Washington Aug. 1970 70 p refs

(NASA-TN-D-5929; L-6981) Avail: CFSTI CSCL 03B

The selenographic coordinates of many distinct lunar features in the vicinity of Sinus Medii were calculated with an estimated uncertainty in the absolute position of + or − 1 km by a digital computer program using film readings from eight sequences (strips) of Lunar Orbiter photographs which contained common lunar terrain. The film readings from three strips of photographs exposed from three consecutive orbits during the second Lunar Orbiter mission were processed both separately (a "strip" solution) and in various combinations ("block" solutions). A comparison of the selenographic coordinates resulting from the various block and strip solutions revealed that a block solution involving data from consecutive orbits computed from a common data arc was the preferred solution. Also, a comparison of the results of block solutions involving data from different missions and different data arcs revealed significant biases to exist in either latitude or longitude. In all cases studied, the lunar radii were found to compare favorably. As a result of this study, the selenographic coordinates of lunar features were calculated from film readings on mission II film for each of the five original Apollo landing sites and the results are portrayed in contour charts. Author

N70-34434*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE CAPTURE PROBABILITIES OF RESONANCE ROTATION FOR MERCURY

Han-Shov Liu Jul. 1970 25 p refs Submitted for publication

(NASA-TM-X-63993; X-643-70-292) Avail: CFSTI CSCL 03B

The computer solutions of Mercury's rotation near the 3:2 resonance spin rate disprove the theories of capture probabilities for resonance rotation in the solar system. The pitfalls of the averaging procedure in the theories of capture probabilities are pointed out. It is shown that the capture process of Mercury's rotation near the 3:2 resonance spin rate is not a probabilistic affair and that the values of capture probabilities for resonance rotation were trapped into the pitfalls of the averaging methods. Author

N70-34495# Brookhaven National Lab., Upton, N.Y.

THERMONUCLEAR REACTIONS IN THE SUN'S INTERIOR AND THE SOLAR NEUTRINOS

G. E. Kocharov et al Mar. 1970 10 p refs Transl. into ENGLISH from the Russian

(BNL-TR-340) Avail: CFSTI

The possibility of a decreased solar neutrino flux based on a hypothesis of the existence of a fairly large quantity of He-3 in the sun's composition and on the existence of a new mechanism for the production of energy in the sun's interior is considered. NSA

N70-34549 National Lending Library for Science and Technology, Boston Spa (England).

SOLAR RESEARCH: NOTES FROM MOSCOW, NO. 192

25 Feb. 1970 3 p Transl. into ENGLISH from Russian newspaper (NLL-Trans-192-(6167.650)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The activities are described for the Kislovodsk observatory with the world's largest coronagraph which permits precise observations of the solar corona. A current activity in progress is the study of the effects of solar activity on the terrestrial biosphere. F.O.S.

N70-34690*# National Aeronautics and Space Administration, Washington, D.C.

THE PROBLEM OF THE EXISTENCE OF FREE PHYSICAL LIBRATION OF THE MOON [K VOPROSU O SUSHCHESTVOVANII SVOBODNOY FIZICHESKOY LIBRATSII LUNY]

Sh. T. Khabibullin Aug. 1970 9 p refs Transl. into ENGLISH from Tr. Kazansk. Gor. Astron. (USSR), no. 35, 1968 p 110–115

(NASA-TT-F-13150) Avail: CFSTI CSCL 03A

It is shown that the amplitude of the natural oscillations in the Moon's rotation has fallen to such a low level that it is impossible to detect with existing methods of observation. The possibility of meteor impacts maintaining the Moon's physical libration is rejected. Author

N70-34710*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

GENERAL PARAMETRIC REENTRY STUDY FOR SEVERAL SYNCHRONOUS EARTH ORBITS

William R. Pruett 3 Feb. 1967 95 p

(NASA-TM-X-64401; MSC-67-FM-15) Avail: CFSTI CSCL 22

This paper presents the graphic results of a reentry study for five synchronous earth orbits. In keeping with the broad definition of synchronous orbits, each of these orbits has a period of approximately 23.93 hours. The results are presented in figures of inertial velocity and flight-path angle at 400,000 feet. Also presented are the central angle of travel (orbit referenced) and the time from retrofire to 400,000 feet. For the elliptic orbits these parameters are plotted as a function of true anomaly of retrofire, and for the circular orbit they are plotted as a function of retrograde delta V. Both pitch attitude and delta V were varied for study. Author

N70-34712*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

A PARAMETRIC STUDY OF CENTRAL ANGLE OF TRAVEL AND TIME FOR REENTRY FROM NEAR-EARTH CIRCULAR ORIBTS

William R. Pruett 31 Oct. 1966 13 p refs

(NASA-TM-X-64403; MSC-66-FM-126) Avail: CFSTI CSCL 22C

This study is a continuation of the circular orbit portion of reference 1, "General Parametric Study for Near-Earth Orbits". Contained in this report are the orbit-referenced central angle of travel from retrofire to 400,000 ft and the time from retrofire to 400,000 ft as functions of circular orbit altitude. The same ranges of retrograde pitch angles, retrograde delta V's and circular orbits are used in this report as were used in reference 1. Since reference 1 presents reentry velocity and flight-path angle at 400,000 ft, this document and reference 1 should be used together to obtain a more valuable picture of reentry conditions. Author

N70-34758*# Texas Univ., Austin. Applied Mechanics Research Lab.

THE DERIVATION OF A GENERAL PERTURBATION SOLUTION AND ITS APPLICATION TO ORBIT DETERMINATION

George H. Born Aug. 1968 155 p refs

(Contract NAS9-6963)

(NASA-CR-109928; TR-1001) Avail: CFSTI CSCL 22C

A first order general perturturbation solution is developed for the motion of a satellite under the influence of an arbitrarily shaped primary body and a point mass third body. A set of nonsingular orbit elements is used to describe the satellite's motion and, therefore, the results are valid for all circular and elliptical motion. The general perturbation solutions are then incorporated into an accurate and rapid orbit determination program which is valuable for doing preliminary design work. Its value as a research tool is demonstrated by using it for a study of several problems associated with orbit determinations. Author

N70-34800# California Univ., Berkeley. Dept. of Physics.

MASS SPECTROSCOPY RESEARCH Progress Report

Sep. 1969 15 p Sponsored by AEC

(UCB-34P32-PR4) Avail: CFSTI

A list of papers published and papers in process is given and short discussions are given for each paper. Work in progress is briefly discussed in terms of Ar-39 to Ar-40 dating of meteorites, xenon in whitlockite from St. Severin, composition of fission Xe from laboratory samples of transuranic nuclides (including Pu-244), and preparations for analyses of lunar samples. Work planned for 1970 is mentioned. NSA

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-33456*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REVISED LUNAR SURFACE TEMPERATURES AND THERMAL CHARACTERISTICS FROM SURVEYOR
L. D. Stimpson, W. A. Hagemeyer, J. W. Lucas, Z. Popinski, and J. M. Saari (Boeing Sci. Res. Labs., Seattle) *In its* Analysis of Surveyor Data 30 Jun. 1969 p 1–33 refs (See N70-33455 18-30)
Avail: CFSTI CSCL 22A

The work of the Surveyor lunar surface thermal properties group is summarized for the period from July 1968 to June 1969. The lunar surface temperatures and thermal characteristics derived from the Surveyor telemetry data were revised using more complete spacecraft models and more extensive use of computers. A radiative heat balance equation was used that took into account several effects such as direct solar illumination, indirect heating, shadowing from the spacecraft, and heat loss from the compartment interior. Error analyses were performed to resolve discrepancies between Surveyor and earth-based measurements. R.B.

N70-33749*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION OF THE SERT 2 SPACECRAFT AND MISSION
Richard G. Goldman, Guy S. Gurski, and William H. Hawersaat [1970] 17 p refs Presented at the 8th Elec. Propulsion Conf., Stanford, Calif., 31 Aug. – 2 Sep. 1970; sponsored by AIAA
(NASA-TM-X-52862) Avail: CFSTI CSCL 22B

This paper is a description of the SERT II spacecraft and its mission. The mission purpose and the orbital flight plan to accomplish this purpose will be discussed. The SERT II objectives are to prove the reliability and endurance capability of an ion thruster; develop and refine operational procedures; ascertain operating characteristics in the space environment; and validate ground test results. A mission objective of six months continuous operation of one thruster system is expected to be achieved by a flight program stressing the use and application of reliable, space-proven components and design philosophies. Author

N70-33984*# LTV Aerospace Corp., Dallas, Tex. Missiles and Space Div.
REVISED LUNAR MODULE ASCENT STAGE THERMAL MODEL HANDBOOK
D. A. De Laughter, H. R. Howell, and R. J. French 8 May 1970 376 p refs revised
(Contract NAS9-6807)
(NASA-CR-108468; Rept-350.22-Rev) Avail: CFSTI CSCL 22B

The revised Lunar Module Ascent Stage baseline thermal model is presented. This configuration was obtained by updating the Lunar Module No. 5 (LM-5) baseline thermal model through the use of the Grumman Aerospace Corporation (GAC) LM-6 Ascent Stage Thermal Network baseline data listing and several revisions to that thermal network provided by GAC. The LM-6 Ascent Stage (A/S) thermal model has been prepared for use with the Lunar Module Ascent Stage Routine (LMAR) master program tape. The updated LM A/S baseline thermal model represents the LM-6 through LM-9 configuration and the node diagrams and complete data tape listing are presented. The revised external node configuration of the LM-6 A/S is also presented. Author

N70-34103*# General Electric Co., Philadelphia, Pa. Space Div.
NIMBUS E AND F STUDY Final Report, 27 Jun. 1968–30 Apr. 1970
30 Apr. 1970 57 p
(Contract NAS5-11570)
(NASA-CR-109875) Avail: CFSTI CSCL 22B

A study was conducted to define the system considerations and requirements for design and development of the Nimbus 5 and 6 spacecraft. The various modifications and performance tests carried out are summarized. A detailed breakdown is given for the task assignments performed on the study. R.B.

N70-34135* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLEXIBLE FOAM ERECTABLE SPACE STRUCTURES Patent
Edward L. Hoffman, inventor (to NASA) Issued 24 Aug. 1965 (filed 16 May 1962) 4 p Cl. 343-833
(NASA-Case-XLA-00686; US-Patent-3,202,998;
US-Patent-Appl-SN-195347) Avail: US Patent Office CSCL 22B

Self-erectable space structures are described for application in orbit about the earth and other celestial bodies. The structures are made from an open cellular flexible foam such as polyether urethane to provide the primary support and erection mechanism. An erectable yagi disk antenna element is described in which only the elongated director assembly of the element is erectable with layers of the compressible foam replacing the conventional rod and serving as the sole supporting structure for the spaced disks. In self-erecting solar concentrators or reflectors the foam is preformed in the desired configuration and serves as a backing or support for the reflective surface. Such structures are essentially immune to micrometeroid damage. R.B.

N70-34159* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PIVOTAL SHOCK ABSORBING PAD ASSEMBLY Patent
Josef F. Blumrich, inventor (to NASA) Issued 28 Sep. 1965 (filed 14 Apr. 1964) 6 p Cl. 248-188.9
(NASA-Case-XMF-03856; US-Patent-3,208,707;
US-Patent-Appl-SN-416941) Avail: US Patent Office CSCL 22B

A pivotal shock absorbing assembly is described for use as the touch-down and load distributing portion in the landing gear systems of space vehicles. The assembly consists of a hollow spherical curved pad having radially collapsible ribs or spokes which are designed to absorb by collapsing or crumbling a substantial amount of any lateral shock applied to the edge of the pad. The use of a ball joint for securing the pad to the landing gear system assures that the pad will always present a positive angle of attack to the landing surface. R.B.

N70-34176* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RECOVERABLE ROCKET VEHICLE Patent
Hans F. Wuenscher, inventor (to NASA) Issued 24 Aug. 1965 (Filed 8 Nov. 1961) 16 p Cl. 244-1
(NASA-Case-XMF-00389; US-Patent-3,202,381;
US-Patent-Appl-SN-151114) Avail: US Patent Office CSCL 22B

A technique is proposed for recovery of multistage liquid or solid propellant rocket vehicles after burnout. The individual stages of the vehicle are formed in such a way that each stage comprises several separable, aerodynamically self-sufficient components. Lift producing surfaces are provided on each separable tank structure or section so that each tank is a self-contained, flyable vehicle. R.B.

N70-34184*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO ENTRY SUMMARY DOCUMENT: MISSION OF (AS-505/106/LM-4)
James O. Rippey 17 Mar. 1969 78 p refs

(NASA-TM-X-64317; MSC-CF-P-69-7) Avail: CFSTI CSCL 22A

The purpose of the entry summary document is to provide a single source of entry crew procedure information for use in flight planning, crew training, and preparing onboard data. The techniques contained in this document were generally derived from other documentation and are combined here to serve as a single, compact training package. Author

N70-34185*# National Aeronautics and Space Administration, Washington, D.C.

APOLLO 5 MISSION: Final Flight Evaluation Report

Oct. 1968 135 p refs Prepared by Boeing Co.

(Contract NASw-1650)

(NASA-TM-X-64327; D2-117017-2) Avail: CFSTI CSCL 22A

A final flight evaluation report for the Apollo 5 mission is presented. It includes data from the MSC, MSFC, and KSC mission reports. A description of the mission is provided, giving a summary of planned mission, events and details of the mission as flown. The impact of this mission, the degree of objective accomplishments, and their effect on future Apollo missions is discussed. Significant mission anomalies are presented for carry-over into subsequent flight readiness reviews. Following the list of the significant anomalies, all anomalies resulting from this mission are listed separately. Author

N70-34189*# National Aeronautics and Space Administration, Washington, D.C.

ORBITING FROG OTOLITH (OFO): PRESS KIT

12 Aug. 1970 30 p

(NASA-News-Release-70-132) Avail: NASA Scientific and Technical Information Division CSCL 22B

Background data are presented on the scheduled double launch of the Orbiting Frog Otolith (OFO) and Radiation Meteroid (RM) spacecraft by a single solid propellant Scout vehicle. Two male bullfrogs will be monitored in the OFO for about five days alternatively in the weightlessness of space and during periods of partial gravity created by spinning them up to 50 revolutions per minute, producing a one-half g acceleration condition. This experiment is being conducted to obtain information on the adaptability of the vestibule in the inner ear to a sustained weightless environment as well as its response to acceleration. The RM spacecraft carries the radiation experiment and the meteoroid experiment. Objectives are to demonstrate the feasibility and accuracy of an advanced radiation dosimetry system and to verify in-flight improved instrumentation to measure meteoroid impact, flux, direction, and speed. M.G.J.

N70-34190*# Boeing Co., Washington, D.C. Launch Systems Branch.

SUMMARY OF VIBRATION AND ACOUSTIC TESTS ON FOUR SPACECRAFT PROGRAMS

28 Jun. 1968 348 p refs

(Contract NASw-1650)

(NASA-CR-109902; D2-120001-2) Avail: CFSTI CSCL 22B

The vibration and acoustic test programs are summarized for four spacecraft: Mariner, Lunar Orbiter, Gemini and Surveyor. Information is presented on laboratory test programs and results, flight results, derivation of test levels, identification of test factors, and spacecraft contractor conclusions and recommendations. Author

N70-34198*# National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.

FREE OSCILLATION DYNAMIC STABILITY CHARACTERISTICS OF THE APOLLO LAUNCH ESCAPE VEHICLE WITH AND WITHOUT POST-ABORT CANARD SURFACES AT MACH NUMBERS OF 0.50, 0.70, 0.80, 1.59 and 1.98

Mark B. Nolan 18 May 1966 50 p refs Program Apollo Working Paper No. 1201

(NASA-TM-X-64313) Avail: CFSTI CSCL 22B

The results of subsonic and supersonic wind tunnel tests are presented. The results indicate that the Apollo launch escape vehicle with and without canard surfaces has satisfactory dynamic stability characteristics to perform the Apollo launch abort mission as presently defined at the flight conditions simulated by this test. It was also determined that the configurations tested were dynamically unstable in the immediate region of trim. The launch escape vehicle with canards had a limit cycle of about + or − 40 deg in the heat shield forward trim attitude at subsonic Mach numbers. Supersonically the vehicle had a limit cycle of + or − 15 deg about the heat shield forward trim attitude except for the maximum inertia test condition where it was stable about trim. The launch escape vehicle without canards had a limit cycle of + or − 2 deg in the rocket-forward attitude at subsonic Mach numbers while it is stable in this attitude at the supersonic Mach numbers. In the heat shield forward trim attitude the limit cycle varied from about + or − 60 deg at the lowest Mach number to + or − 0 deg, stable, at the highest Mach number. Author

N70-34225*# National Aeronautics and Space Administration, Washington, D.C.

APOLLO 8 MISSION: FINAL FLIGHT EVALUATION REPORT

Apr. 1969 47 p refs Prepared by Boeing Co.

(Contract NASw-1650)

(NASA-TM-X-64325; D2-117017-5) Avail: CFSTI CSCL 22A

The final flight evaluation report for the Apollo 8 mission is presented. Data from the NASA center 3-day, 15-day, 30-day and 60-day mission reports are included as well as the anomaly status reports from MSC and the Apollo 9 flight readiness review. A summary of the mission, a summary of mission accomplishment, and the anomalies encountered during the mission are included. The anomalies are listed in a separate section according to spacecraft, launch vehicle and ground systems. Author

N70-34226*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT: PIONEER 8 PRELAUNCH THROUGH MAY 1968, VOLUME 3

N. A. Renzetti 15 Jul. 1970 232 p refs

(Contract NAS7-100)

(NASA-CR-109892; JPL-TM-33-426) Avail: CFSTI CSCL 22B

The Pioneer VIII mission (outward trajectory and heliocentric orbit) employed seven scientific instruments to accumulate information relative to interplanetary high-energy particles, solar phenomena, and plasma. The spacecraft also served as a celestial mechanics experiment reference point, and carried aloft a piggyback satellite, called the Test and Training Satellite, to be used for Apollo ground station crew training and mission simulation. The Tracking and Data System (comprising the Air Force Eastern Test Range, Deep Space Network, Manned Space Flight Network, and NASA Communications Network) tracked the spacecraft from launch through the near-earth and deep space phases of the mission. For near-earth tracking, all Tracking and Data System facilities responded to mission, launch-vehicle, and range requirements. For deep space tracking, the Deep Space Network responded to tracking, telemetry, command, monitoring, simulation, and operations control requirements. For Vol. 1 and 2 see N70-19841 and N70-28130. Author

N70-34252*# National Aeronautics and Space Administration, Washington, D.C.

APOLLO 10 MISSION: FINAL FLIGHT EVALUATION REPORT

Aug. 1969 125 p refs Prepared by Boeing Co.

(Contract NASw-1650)
(NASA-TM-X-64315; D2-117017-7) Avail: CFSTI CSCL 22A

Data are presented from the NASA Center 5-day, 30-day, and 60-day reports, and the Apollo 11 flight readiness review. The report includes a summary of the mission, a summary of mission accomplishments, and the anomalies encountered during the mission. The anomalies are listed separately according to launch vehicle, spacecraft, and ground systems. Author

N70-34296* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ERECTABLE MODULAR SPACE STATION Patent
Rene A. Berglund, inventor (to NASA) Issued 16 Feb. 1965 (Filed 24 May 1962) 8 p Cl. 244-1
(NASA-Case-XLA-00678; US-Patent-3,169,725; US-Patent-Appl-SN-197551) Avail: US Patent Office CSCL 22B

A manned space station is described which has rigid living compartments capable of being completely collapsed and stored in the payload stage of the launch vehicle, launched into a planetary orbit, and which is self-erecting. The design utilizes rigid cylindrical sections equipped for life support and experiments before launch and joined together by flexible connectors. The sections are connected to a central hub and are erectable to form a rigid hexagonal, tubular ring of sufficient diameter to provide the mass and volume necessary to produce artificial gravity. R.B.

N70-34305*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE EFFECTS OF WIND FORCES ON A THRUSTING LAUNCH VEHICLE AND LAUNCH ESCAPE SYSTEM FOR APOLLO MODE 1 ABORTS
Donald L. Dietrick 23 Jan. 1968 155 p refs
(NASA-TM-X-64295; MSC-68-FM-22) Avail: CFSTI CSCL 22D

The effect of wind forces on a launch vehicle (LV) trajectory and launch escape system (LES) trajectory of a thrusting vehicle was investigated up to and during mode I aborts. The effect of wind forces on the command module (CM) landing points computed by the mode-I-abort CM-landing-point-prediction program was studied to verify the current real-time mode-I-abort landing-prediction technique employed by the Real Time Auxiliary Computing Facility (RTACF). Six-degress-of-freedom (DOF) computer programs for the LV and mode I abort simulations were used to generate data for the study. It was found that wind forces do affect the position and body attitudes of a thrusting vehicle. When these effects are not considered in the mode-I-abort CM-landing-point predictions, accuracy is degraded. Author

N70-34310*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CREW EGRESS PROCEDURES FOR APOLLO BLOCK 1 COMMAND MODULE AT SEA
Harold J. Clancy and Reed M. Darley 7 Dec. 1966 53 p Program Apollo Working Paper No. 1213
(NASA-TM-X-64311) Avail: CFSTI CSCL 22A

All four possible modes of egress were investigated — the main crew hatch and forward hatch in stable 1 (normal flotation) and both of these again in stable 2 (inverted flotation). Check list procedures were developed for all cases. Stable 2 egresses were considered only as being contingent. Egress through the forward hatch and main crew access hatch in Stable 2 found to be feasible. In the case of the main crew hatch egress in Stable 2, the present proposed center of gravity (X = 37 in., Y = 0.5 in., and Z = 4.5 in.), and concomitant flotation attitude could result in the loss of the spacecraft. The forward hatch egress in Stable 2 would not result in the loss of the spacecraft as long as the crew compartment air pocket is maintained. Author

N70-34311*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
WARNING TIME REQUIRED BY THE APOLLO SPACECRAFT TO SUCCESSFULLY ABORT IN THE EVENT OF A LAUNCH VEHICLE EXPLOSION
Charles Teixeira 14 Sep. 1966 71 p refs Program Apollo Working Paper No. 1211
(NASA-TM-X-64314) Avail: CFSTI CSCL 22D

Explosion of a Saturn launch vehicle stage will result in pressures which exceed the Apollo command Module's pressure limits if a sufficient separation does not exist between the command module and the explosion A study was made to determine the separation (in terms of time from abort initiation to the time of explosion) required in order that the command module pressure limits are not exceeded. This time is referred to as the required warning time. The study considered the individual explosion of the three Saturn 5 stages and the two Saturn IB stages from the pad to an altitude of 60,000 feet. The required warning times are the longest on the pad and in the 25,000 to 30,000 foot regime. The maximum warning time required for the S-IB, S-4B (Saturn IB), S-IC, S-2 and S-4B (Saturn 5) are 2.68, 3.31, 3.30, 5.88, and 3.50 seconds respectively. Sensitivity of the required warning times to changes in such parameters as launch escape motor thrust, command module pressure limit, and the TNT equivalent yield, were also considered. Author

N70-34315*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO ENTRY SUMMARY DOCUMENT: MISSION C PRIME
L. D. Carrico, R. J. Otto, Jr., W. W. Hinton, Jr., and James O. Rippey 29 Oct. 1968 86 p refs
(NASA-TM-X-64322; MSC-CF-P-68-24) Avail: CFSTI CSCL 22A

A single source of entry crew procedures information for use in flight planning, crew training, and preparing onboard data is presented for the C-Prime Mission. The procedures are divided into lunar return entry procedures and earth orbital entry procedures. The lunar return entry procedures are presented in a continuous timeline while the earth orbital entry procedures are subdivided into deorbit preparation, deorbit, and entry procedures. This subdivision of the procedures is necessary to include the two types of deorbit burns (PBNCS/SCS SPS burn, PGNCS/SCS RCS (Including Hybrid) burn). The deorbit preparation procedures and the entry procedures are compatible with each of the deorbit burn procedures. Preceding each set of procedures is a description of the major events that occur during the normal step by step execution of the procedures. Author

N70-34318*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO ENTRY SUMMARY DOCUMENT: MISSION C (SA-205, S/C-101)
Munshi A. Rahman 21 Jun. 1968 87 p
(NASA-TM-X-64321; MSC-CF-P-68-11) Avail: CFSTI CSCL 22A

A single reference source of information and crew procedures is provided to be used during entry training. The information reflects flight planning procedures in effect at the present time. The basic summary reflects the control procedures to be used by the crew. The appendices supplement the controlled procedures for training purposes. Author

N70-34347*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SATURN S-4B-507 STAGE ACCEPTANCE FIRING REPORT
Dec. 1968 268 p
(Contract NAS7-101)
(NASA-CR-109934; DAC-56727) Avail: CFSTI CSCL 22D

An evaluation is reported for the Saturn S-4B-507 stage acceptance firing that was conducted at the Sacramento Test

Center on 16 October 1968. Included in this report are stage and ground support equipment deviations associated with the acceptance firing configuration. Author

N70-34348*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SATURN S-4B-509 NARRATIVE END ITEM REPORT, SUPPLEMENT
W. M. Reitzell Apr. 1969 224 p
(Contract NAS7-101)
(NASA-CR-109935; DAC-56662-Suppl) Avail: CFSTI CSCL 22D

Narrations are included on conditions of Saturn S-4B-509 stage related to permanent nonconformances which were generated during the manufacturing cycle and existed at the time of Space Systems Center acceptance testing. The report sets forth data pertinent to total time or cycle accumulation on time or cycle significant items. Data relative to variations in flight critical components are also included. Author

N70-34365*# National Aeronautics and Space Administration, Washington, D.C.
APOLLO 7 MISSION: FINAL FLIGHT EVALUATION REPORT
Feb. 1969 72 p refs Prepared by Boeing Co.
(Contract NASw-1650)
(NASA-TM-X-64324; D2-117017-4) Avail: CFSTI CSCL 22A

The flight evaluation of the Apollo 7 mission includes data from the 3 day, 15 day, 30 day, and 60 day mission reports, the subsystems meeting, and the anomaly status reports for MSC and the Apollo 8 flight readiness review meeting. Summaries of the mission, mission accomplishments, and the anomalies encountered during the mission are included. Author

N70-34370*# National Aeronautics and Space Administration, Washington, D.C.
APOLLO 9 MISSION: Final Flight Evaluation Report
Jun. 1969 110 p refs Prepared by Boeing Co.
(NASA-TM-X-64316; D2-117017-6) Avail: CFSTI CSCL 22B

Data are presented from the NASA Center 5-day, 30-day, and 60-day reports as well as the anomaly status reports from MSC and the readiness assessment material for the Apollo 10 mission. The report includes a summary of the mission, a sequence of mission events, a listing of the mission objective accomplishments, and the anomalies encountered during the mission. The anomalies are listed according to spacecraft, launch vehicle, and ground systems. Author

N70-34371*# National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.
AN ANALYSIS OF THE LAND IMPACT PROBLEM DURING MODE 1 ABORTS FROM THE SATURN 1B LAUNCH VEHICLE
Samuel R. Newman, Robert E. Prahl, and Dallas G. Ives 6 Nov. 1967 34 p refs
(NASA-TM-X-64310; MSC-67-FM-167) Avail: CFSTI CSCL 22D

Mode 1 aborts from the Saturn IB launch vehicle have been studied to evaluate the land impact problem. Both statistical wind data and measured wind data were used. The study shows that the possibility of a landing exists and depends greatly on the wind velocity and azimuth. Author

N70-34388*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SATURN S-4B-508N STAGE ACCEPTANCE FIRING REPORT
Sep. 1968 265 p
(Contract NAS7-101)
(NASA-CR-109896; SM-47462) Avail: CFSTI CSCL 22B

This report presents an evaluation of the Saturn S-4B-508N stage acceptance firing that was conducted on 17 Jul. 1968. Included in this report are stage and ground support equipment deviations associated with the acceptance firing configuration. The acceptance firing test program established the acceptance criteria for buyoff of the stage. Author

N70-34387*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SATURN S-4B-507 NARRATIVE END ITEM REPORT
W. M. Reitzell Apr. 1969 434 p
(Contract NAS7-101)
(NASA-CR-109937; DAC-56823) Avail: CFSTI CSCL 22D

Contained herein is a narrative summary of the Sacramento Test Center test records relative to the Saturn S-4B-507 flight stage. Narrations are included on those conditions related to permanent nonconformances which were generated during the manufacturing cycle and existed at the time of acceptance testing. The report sets forth data pertinent to total time or cycle accumulation on time or cycle significant items. Data relative to variations in flight critical components are also included. There is no provision to update or revise the NEIR after the initial release. Author

N70-34388*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYNCHRONOUS METEOROLOGICAL SATELLITE PHASE B STUDY REPORT
D. V. Fordyce and M. B. Weinreb, comp. Jan. 1970 256 p refs
(NASA-TM-X-63980; X-460-70-30) Avail: CFSTI CSCL 22B

The general philosophy used in the Phase B study has been the design of a base-line system which meets the minimum requirements while being as compatible as possible with the current configuration of the ESSA CDA ground station. While so doing, an attempt has been made to keep the total system flexible so that the ultimate goals can be achieved whenever resources are available to modify the ground system, which is the principal constraint on obtaining the growth potential of the total system. Author

N70-34389*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GOESTAR-1 A GEOPOTENTIAL AND STATION POSITION RECOVERY SYSTEM
C. E. Velez and G. P. Brodsky Nov. 1969 233 p refs
(NASA-TM-X-63979; X-553-69-544) Avail: CFSTI CSCL 22B

The GEOSTAR-I multiple arc geopotential and station position estimation system is described. A detailed presentation of the mathematical model and formal documentation of the principal program components are included. Author

N70-34392*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A MATHEMATICAL ANALYSIS OF THE STABILITY OF A LUNAR FLYING VEHICLE WITH MANUAL CONTROLS
David Hall 5 Sep. 1968 42 p refs *Its* General Working Paper No. 10079
(NASA-TM-X-64334) Avail: CFSTI CSCL 22B

Equations of motion for a four-degree-of-freedom mathematical model of the lunar flying vehicle are developed and used to study the stability of the autonomous vehicle. The human pilot describing function is used to represent the control system and derive the stability criteria for the closed-loop attitude control system. Author

N70-34394*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PRELIMINARY BACKUP ABORT PROCEDURES FOR ABORTS OCCURRING DURING TRANSLUNAR INJECTION: PROJECT APOLLO
Bobbie D. Weber 2 Oct. 1967 23 p refs

(NASA-TM-X-64335; MSC-67-FM-143) Avail: CFSTI CSCL 22A

An analysis was conducted to determine the feasibility of performing a fixed-attitude abort maneuver for premature S-4B shutdowns during the translunar injection (TLI) maneuver. The results show it is operationally feasible to perform a fixed-attitude, fixed delay time abort following a premature S-4B shutdown. The backup abort procedures to be followed for this type abort are presented. Author

N70-34395*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

A DESIGN PARAMETER SYNTEHSIS DERIVED FROM A MATHEMATICAL ANALYSIS OF A HYPOTHETICAL LUNAR FLYING VEHICLE

William M. Jacqmein 11 Apr. 1969 35 p refs General Working Paper No. 10084

(NASA-TM-X-64333) Avail: CFSTI CSCL 22B

The purpose of this study is to develop design information from a mathematical analysis of a manually controlled lunar flying vehicle. The equations developed in that paper are discussed with respect to feasible vehicle configurations and the corresponding differences which arise from the use of thrust vector as opposed to kinesthetic control. Experimental data concerning the human pilot describing function are employed in the development of a stable region and a region of comfortable control expressed in terms of vehicle parameters. The equations representing vehicle parameters are investigated, and favorable lunar flying vehicle configurations indicated by this analysis are described. Author

N70-34405*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO 2 (MISSION G) SPACECRAFT DISPERSION ANALYSIS. VOLUME 2: TRANSLUNAR AND TRANSEARTH PHASES

G. C. Hitt, (TRW Systems Group), S. M. Kindall, (TRW Systems Group), and J. D. Yencharis 1 Jul. 1969 47 p refs

(NASA-TM-X-64387; MSC-69-FM-180-Vol-2) Avail: CFSTI CSCL 22C

The results of the spacecraft dispersion analyses for the translunar and transearth phases of Apollo (Mission G) are presented in this document. The analyses were performed based on the Apollo 11 operational trajectory. Of the 200 translunar phase and 200 transearth phase simulations which were performed, the worst cases resulted in total service propulsion system expenditures of 53.6 fps and 17.2 fps for the translunar and transearth phases, respectively. Worst-case reaction control system expenditures were 5.5 fps for the translunar phase and 14.6 fps for the transearth phase. Trajectory deivations at lunar orbit insertion and at entry are smaller than those obtained from preflight analyses for the Apollo 10 mission and appear to be acceptable. Author

N70-34409*# TRW Systems Group, Redondo Beach, Calif.

EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 1: SUMMARY Final Report

17 Apr. 1970 111 p

(Contract NAS5-11260)

(NASA-CR-109913) Avail: CSFTI CSCL 22B

An overall description of the development of the Earth Resources Technology Satellite is presented, including the observatory, ground data handling system, and the data collection system. Performance requirements and performance achievements are summarized. A list of study tasks and results is included. F.O.S.

N70-34410*# TRW Systems Group, Redondo Beach, Calif.

EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 2: ERTS SYSTEM STUDIES Final Report

17 Apr. 1970 281 p refs

(Contract NAS5-11260)

(NASA-CR-109912) Avail: CFSTI CSCL 22B

The results of Phase B/C studies of the ERTS system that encompass elements of both the observatory and the ground data handling system, or that can affect factors in the program beyond these two systems are reported. Four specific studies are involved: (1) booster vehicle choice, (2) oribtal analysis, (3) improving GDHS performance through observatory, and modifications (4) total system accuracy. Author

N70-34411*# TRW Systems Group, Redondo Beach, Calif.

EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 3: OBSERVATORY SYSTEM DESIGN Final Report

11 Feb. 1970 256 p

(Contract NAS5-11260)

(NASA-CR-109840) Avail: CFSTI CSCL 22B

The ERTS observatory as a reliable and versatile system capable of gathering information about the world's natural and cultural resources is described. It provides room and weight-carrying capability for installing a variety of sensors including specifically a multispectral point scanner, a triplet of return beam vidicon cameras and their associated electronics, a real time data collection system, and a pair of video tape recorders. It includes an attitude control system which provides accurate three-axis stabilization with the horizon and orbit plane as references and an attitude determination capability for refining knowledge of the relative and absolute location of image points. Power for continuous subsystem operation and for 20 minutes of payload operation has been included. Spacecraft monitoring and control and payload data readout can take place using either STADAN or MSFN ground stations. There is a high probability, 65 percent, that ERTS missions could continue unimpaired for three years. The ERTS design is a logical outgrowth of the OGO program and makes use not only of the technology and design developed but actually incorporates OGO spare parts in many instances. Author

N70-34412*# TRW Systems Group, Redondo Beach, Calif.

EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 4: OBSERVATORY SUBSYSTEMS STUDY Final Report

11 Feb. 1970 529 p refs

(Contract NAS5-11260)

(NASA-CR-109917) Avail: CFSTI CSCL 22B

The application of the OGO technology to the development of an ERTS vehicle is discussed in terms of the verification of the applicability of existing items or techniques, modifications when required, and the development of new equipment. The functions that required new or modified equipment are listed. The spacecraft subsystems are analyzed. F.O.S.

N70-34413*# TRW Systems Group, Redondo Beach, Calif.

EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 5: DATA COLLECTION SYSTEM Final Report

11 Feb. 1970 265 p refs

(Contract NAS5-11260)

(NASA-CR-109911) Avail: CFSTI CSCL 22B

The data collection and transmission system and supporting analyses for ERTS phases B and C are documented. Results of four main investigations are discussed: (1) system concepts (including visibility time and coverage, message structure, error detection coding, link analysis, random emission capacity, radio frequency interference, platform deployment and power sources, antennas, and pulse repetition frequency); (2) hardware design (data collection platform, spacecraft receiver, and ground signal recovery); (3) message collision analysis (time domain, random emission multiple access with replication, dual random time and frequency mode, and computer simulation); and (4) data transmission to GSFC. Ground sensor data collection platform sites will process and transmit data to ERTS for relay to the ground via a unified S-band link for further relay and processing. E.C.

N70-34414*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 6: RELIABILITY PROGRAM PLAN Final Report
17 Apr. 1970 88 p refs
(Contract NAS5-11260)
(NASA-CR-109842) Avail: CFSTI CSCL 22B

The OGO reliability program was revised to meet the ERTS requirements. The plan covers all aspects of reliability for the ERTS phase D contract. Author

N70-34415*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 7: QUALITY PROGRAM PLAN Final Report
17 Apr. 1970 172 p
(Contract NAS5-11260)
(NASA-CR-109920) Avail: CFSTI CSCL 22B

This quality program plan sets forth the quality program requirements for the ERTS project and includes both the observatory and ground data handling systems. It defines the requirements for the effective implementation of a quality program. Author

N70-34416*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 8: TEST MONITORING AND CONTROL PLAN Final Report
17 Apr. 1970 34 p
(Contract NAS5-11260)
(NASA-CR-109926) Avail: CFSTI CSCL 22B

This plan defines the management and implementation of the test monitoring and control effort. The plan is applicable to the observatory data collection and ground data handling system and related software. Author

N70-34417*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITES. VOLUME 9: CONFIGURATION MANAGEMENT PLAN Final Report
17 Apr. 1970 114 p
(Contract NAS5-11260)
(NASA-CR-109922) Avail: CFSTI CSCL 22B

The ERTS configuration, engineering drawing, specification, test procedure, baseline, and change identifications are considered for defining methods used to manage and segregate technical data for the total ERTS system. Configuration accounting is summarized for publication and issuance of reports emanating from the operational divisions and supporting functions. A system of informal and formal change controls for computer program configured items is examined, along with subcontractor configuration management. The method and procedure for identifying and listing the complete engineering data required to implement approved engineering changes for the ERTS project were established. J.A.M.

N70-34418*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITES. VOLUME 10: SOLDERING PROGRAM PLAN Final Report
11 Feb. 1970 70 p
(Contract NAS5-11260)
(NASA-CR-109921) Avail: CFSTI CSCL 22B

Basic principles are described for hand and machine soldering requirements for reliable electrical and electronic equipment. The supplier soldering program is briefly reviewed, along with the various facilities, equipment, and materials used in the different types of soldering. Soldering preparation, mounting, conductor attachment to terminals, terminal and printed wiring assembly soldering, and automatic soldering of printed circuit boards are also noted. J.A.M.

N70-34419*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITES. VOLUME 11: FAILURE REPORTING PLAN Final Report
17 Apr. 1970 36 p
(Contract NAS5-11260)
(NASA-CR-109925) Avail: CFSTI CSCL 22B

Hardware and software experience gained through comprehensive failure reporting and analysis is utilized, and the corrective action to ensure that the probability of failure recurrence is reduced to acceptable levels is examined. Divisional and software failure controls are also reviewed. J.A.M.

N70-34420*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITES. VOLUME 12: OBSERVATORY INTEGRATION AND TEST PLAN AND LAUNCH OPERATIONS PLAN Final Report
11 Feb. 1970 81 p refs
(Contract NAS5-11260)
(NASA-CR-109927) Avail: CFSTI CSCL 22B

Subsystem level tests, payload integration and test, pre-environmental and post-environmental tests, final payload, spacecraft tests, and alignment checks prior to shipment to the launch site are outlined. Test management procedures, test equipment, and facilities plannad for implementation of the test program are summarized. A building block philosophy is utilized during integration of subsystem assemblies into the spacecraft which, coupled with methodical testing and monitoring, assured mutual compatibility and proper operation of each subsystem. The launch readiness review, launch site activation, and launch operations are discussed, along with flight worthiness of the spacecraft documented during the launch readiness review. J.A.M.

N70-34421*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 13: GDHS STAFFING AND MATERIAL USAGE PLAN Final Report
17 Apr. 1970 79 p refs
(Contract NAS5-11260)
(NASA-CR-109919) Avail: CFSTI CSCL 22B

The personnel requirements analyses, resultant staffing requirements, and material usage requirements are presented for the ERTS Ground Data Handling System. A description of the positions required, the manning requirements, the training program, and the technical manuals are also included. A manpower cost estimate for the operation and maintenance of the GDHS is also provided. The staffing requirements are based upon three separate work areas which functionally segregate the GDHS equipment and work stations into the Operation Control Center, the NASA Data Processing Facility, and the Automatic Data Processing Equipment of the NDPF. Items required to set-up operations and expendables consumed in one year of operation are tabulated for the OCC, the ADPE, and Image and Photo Processing. Author

N70-34422*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 14: GROUND DATA HANDLING SYSTEM DESIGN
17 Apr. 1970 384 p
(Contract NAS5-11260)
(NASA-CR-109838) Avail: CFSTI CSCL 22B

The systems, subsystems, and operations, developed around a generic computer configuration, are described. The operations concepts are described for the Operation Control Center, the NASA Data Processing Facility, computing and display services, and communications and data acquisition. Details are given on the equipment and the data processing for the OCC, NDPF, and the unified display system. The Automatic Data Processing Equipment configuration and computer software are discussed for the OCC and NDPF systems, along with load sharing, software organization, and capsule descriptions. N.E.N.

N70-34423*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 14 APPENDIX: OCC AND NDPF SPECIFICATIONS Final

Report
17 Apr. 1970 165 p
(Contract NAS5-11260)
(NASA-CR-109918) Avail: CFSTI CSCL 22B

The specifications for design, performance, qualification, and acceptance test of the Operation Control Center Subsystem and for the NASA Data Processing Facility Subsystem are presented. The specification for the Ground Data Handling System personnel are also given and cover qualitative and quantitative requirements for position manning by organization functional elements, selection and training of personnel, and operation and maintenance manual requirements. Author

N70-34424*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 15: GROUND DATA HANDLING SYSTEM STUDY Final Report
17 Apr. 1970 71 p
(Contract NAS5-11260)
(NASA-CR-109924) Avail: CFSTI CSCL 22B

The Ground Data Handling System consists of two major elements, The Operation Control Center and the NASA Data Processing Facility. Several studies common to both are presented. A collocation of the OCC and NDPF is analyzed. Facilities, the use of floor space, hazardous times, cooling requirements, and related topics are studied. A digital TV system is analyzed for use in both centers and the requirements are given. Detailed studies are presented on the capacity required for each subtask to obtain the proper size of computer. The sizing was done with respect to the IBM 360. Author

N70-34425*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 15 APPENDIX: FUNCTIONAL ANALYSIS
17 Apr. 1970 168 p
(Contract NAS5-11260)
(NASA-CR-109914) Avail: CFSTI CSCL 22B

The functional flow diagrams and the requirements allocation sheets for the ERTS operations control and data processing are presented. Author

N70-34426*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 16: OPERATIONS CONTROL CENTER STUDIES Final Report
17 Apr. 1970 211 p
(Contract NAS5-11260)
(NASA-CR-109915) Avail: CFSTI CSCL 22B

Equipment requirements for an Operations Control Center for a spacecraft such as ERTS were investigated. The specific design of a center is based on the characteristics of the orbit, the spacecraft, the payload, and ground stations. The data collection and the spacecraft command systems are discussed. Training, simulation, and scheduling problems are outlined. S.S.

N70-34427*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 17: NASA DATA PROCESSING FACILITY STUDIES Final Report
17 Apr. 1970 401 p
(Contract NAS5-11260)
(NASA-CR-109923) Avail: CFSTI CSCL 22B

The data required for system design of the NASA Data Processing Facility (NDPF) is provided. The studies cover not only the techniques which will be used in the final system, but also include those techniques and devices which have been rejected. This provides the rationale upon which the selection of the final design have been made. Alternatives, performance, and problems of techniques are described. The function of the NDPF is to accept data collected by ERTS and to present this data to users, in usable form, properly annotated, and as free as possible from the errors and anomalies introduced by the sensors and the data handling system. It also maintains a library of all past data and the means to retrieve further processes and reproduce them on request. S.S.

N70-34428*# TRW Systems Group, Redondo Beach, Calif.
EARTH RESOURCES TECHNOLOGY SATELLITE. VOLUME 18: AUTOMATIC DATA PROCESSING EQUIPMENT PROCUREMENT Final Report
17 Apr. 1970 37 p
(Contract NAS5-11260)
(NASA-CR-109916) Avail: CFSTI CSCL 22B

Design study specifications for the Earth Resources Technology Satellite require a preparation of the performance characteristics for the Automatic Data Processing Equipment (ADPE) and an issue for Requests for Quotation (RFQ) for the specified equipment, followed by evaluation of responses and selection of proposed equipment subcontractors. Detailed scoring results and discussion of the selection process is presented for some of the 25 companies to which RFQ-'s were issued. The evaluation process led to the recommendation by the Source Evaluation Board for selection of two IBM 360's and one XDS Sigma 5 for the ERTS ADPE. S.S.

N70-34430*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
LH 2 TANK INSULATION OUTGASSING SYSTEM TEST PLAN
J. R. Mc Farlane Nov. 1968 27 p revised
(NASA-CR-109900; DAC-56638B-Rev) Avail: CFSTI CSCL 22B

The total test program requirement to perform the LH2 Insulation Outgassing Systems Test is presented. Tests are described in general terms, and test control drawings are referenced for the actual performance of detailed test procedures. The plan also establishes procedures to handle additions, deletions and changes to the test program. Author

N70-34431*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ADAPTIVE CONTROLLER FOR SPACE BASE SPIN PLANE ORIENTATION
Willard W. Anderson and Ralph W. Will Washington Aug. 1970 38 p refs
(NASA-TN-D-5939; L-7157) Avail: CFSTI CSCL 22B

An adaptive attitude control system for the precise earth orientation of an artificial-gravity space base is presented. The adaptive logic forms a performance index based on the control torques required to hold a constant orientation with respect to the orbit plane in the presence of environmental torques. The adaptive control system acts to minimize this performance index and thus acquires an orientation with respect to the orbit plane where the environmental disturbance bias torques precess the space base at the orbit regression rate. This precession permits the space base to operate at a fixed orientation with respect to the orbit plane with no requirement for steady-state attitude-control fuel. It is also shown that this condition is stable and that any angular offset from this point results in a stable coning motion of the space base pin axis with respect to the orbit plane. Simulation results are presented for both the adaptive control system performance and the space base motions. Author

N70-34433*# National Aeronautics and Space Administration. Washington, D.C.
APOLLO 6 MISSION: FINAL FLIGHT EVALUATION REPORT
Feb. 1969 132 p refs Prepared by Boeing Co.
(Contract NASw-1650)
(NASA-TM-X-64328; D2-117017-3) Avail: CFSTI CSCL 22A

The flight evaluation for the Apollo 6 mission includes data from the MSC, MSFC, and KSC mission reports. A description of the mission is provided, giving a summary of planned mission events and details of the mission as it was flown. The impact of this mission, the degree of objective accomplishments, and their effect on future Apollo missions is discussed. Significant mission anomalies are presented for carry-over into subsequent flight readiness reviews. Following the list of significant anomalies, all anomalies resulting from this mission are listed in a separate section and numbered according to spacecraft, launch vehicle, and ground systems. Supporting material is included, giving the anomaly background, a detailed description, the cause, and corrective actions taken. Author

N70-34437*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

PRELIMINARY LAUNCH ABORT ANALYSIS FOR MANNED APOLLO S-5 MISSIONS

Bobbie D. Weber 18 Jan. 1967. 67 p refs

(Proj. Apollo)

(NASA-TM-X-64329; MSC-67-FM-7) Avail: CFSTI CSCL 22D

A preliminary analysis is presented of aborts during the first powered flight portion of the manned Apollo S-V mission, from lift-off through insertion into earth-parking orbits. The analysis considers primarily the capability of various propulsion systems on the spacecraft to either return the command module (CM) and crew safely to earth immediately following a booster malfunction or to achieve earth orbit from which the CM and crew can deorbit safely or perform an alternate mission. Recommendations are presented for abort mode definition and duration based on this analysis. The primary purpose of the analysis was to provide sufficient data to show the spacecraft capabilities and limitations, so that, if alternatives to the recommendations are considered, data will be available to weigh the advantages and disadvantages of the alternatives. Author

N70-34451*# General Electric Co., Philadelphia, Pa. Space Systems Organization.

EARTH RESOURCES TECHNOLOGY SATELLITE OPERATIONS CONTROL CENTER AND DATA PROCESSING FACILITY. BOOK 1: SYSTEMS STUDIES Final Report

17 Apr. 1970 471 p

(Contract NAS5-11529)

(NASA-CR-109909; Doc-70SD4226-BK-1) Avail: CFSTI CSCL 22B

The Earth Resources Technology Satellite Ground Data Handling System (GDHS) design study is documented, presenting in detail those analyses and tradeoffs required to arrive at a cost-effective design meeting all requirements. Summaries are given of the GDHS design; significant study results; an overview of the functional analyses, requirements, and specifications; and operations control center system design, subsystems, and installation/test and operations studies. Author

N70-34452*# General Electric Co., Philadelphia, Pa. Space Systems Organization.

EARTH RESOURCES TECHNOLOGY SATELLITE OPERATIONS CONTROL CENTER AND DATA PROCESSING FACILITY. BOOK 2: SYSTEMS STUDIES Final Report

17 Apr. 1970 525 p

(Contract NAS5-11529)

(NASA-CR-109939; Doc-70SD4226-BK-2) Avail: CFSTI CSCL 22B

The NASA Data Processing Facility design studies and subsystems analyses are described. Author

N70-34453*# General Electric Co., Philadelphia, Pa. Space Systems Organization.

EARTH RESOURCES TECHNOLOGY SATELLITE OPERATIONS CONTROL CENTER AND DATA PROCESSING FACILITY. BOOK 3: SYSTEM STUDIES Final Report

17 Apr. 1970 258 p

(Contract NAS5-11529)

(NASA-CR-109910; Doc-70SD4226-BK-3) Avail: CFSTI CSCL 22B

Appendicies for the NASA Data Processing Facility system study are presented and include the terrain altitude effects on grid rectification accuracy, information retrieval at scientific installations, information retrieval system for photographic data, free text inputs to utility routines, use of microform techniques, frequency space analysis of line scan systems, precision positioning experiment, and functional requirements of training set analysis computer programs. The NDPF installation, integration, and acceptance test activities are described. The NDPF support functions are discussed and include operational requirements, operational flow, operating timelines, organization, staffing, training, manuals, maintenance, and logistics. N.E.N.

N70-34454*# General Electric Co., Philadelphia, Pa. Space Systems Organization.

EARTH RESOURCES TECHNOLOGY SATELLITE SPACECRAFT SYSTEM DESIGN STUDIES. VOLUME 1: SYSTEMS STUDIES Final Report

11 Feb. 1970 288 p

(Contract NAS5-11529)

(NASA-CR-109907; Doc-70SD4207-VOL-1) Avail: CFSTI CSCL 22B

The baseline spacecraft system design for the earth resources technology satellite is summarized, including spacecraft system design, hardware matrix, and a launch vehicle study. The spacecraft reliability assessment for examining the individual spacecraft subsystem designs and the orbit analysis for evaluating the spacecraft orbit adjust subsystem in terms of its functional capability, sizing, and operational features are reviewed, as well as image location and coverage, time annotation, mission simulation, and management. J.A.M.

N70-34455*# General Electric Co., Philadelphia, Pa. Space Systems Organization.

EARTH RESOURCES TECHNOLOGY SATELLITE SPACECRAFT SYSTEM DESIGN STUDIES. VOLUME 2, BOOK 1: SUBSYSTEMS STUDIES Final Report

11 Feb. 1970 703 p

(Contract NAS5-11529)

(NASA-CR-109837; Doc-70SD4207-Vol 2-BK-1) Avail: CFSTI HC$10.00/MF$0.65

The development of an observatory spacecraft capable of meeting the requirements of the ERTS mission is studied with emphasis on communications and data handling, image location requirements and sensors, electrical integration, thermal control and payload integration. The design constraints, and spacecraft baseline design are given. F.O.S.

N70-34456*# General Electric Co., Philadelphia, Pa. Space Systems Organization.

EARTH RESOURCES TECHNOLOGY SATELLITE SPACECRAFT SYSTEM DESIGN STUDIES. VOLUME 2, BOOK 2: SUBSYSTEMS STUDIES Final Report

11 Feb. 1970 563 p

(Contract NAS5-11529)

(NASA-CR-109908; Doc-70SD4207-VOL-2-BK-2) Avail: CFSTI HC$10.00/MF$0.65 CSCL 22B

The Attitude Control Subsystem recommended for the Earth Resources Technology Satellite is an updated and slightly modified version of the flight qualified Nimbus D stabilization subsystem. Because of differences in mission, orbit, attitude control requirements, etc., the Nimbus stabilization subsystem cannot be used directly, but must be modified to meet the particular requirements of the ERTS mission. The specific areas requiring analysis and evaluation of the Attitude Control Subsystem were identified, the analyses

performed, and the necessary modifications to the attitude control subsystem specified. The proposed ERTS stabilization subsystem and the modifications to the stabilization subsystem to meet the ERTS requirements are presented with descriptions of the orbit adjust subsystem, a thermal control subsystem, and the power subsystem. The electrical integration subsystem includes the distribution harness and the preflight disconnect, power switching module. Electromagnetic interface considerations, integration, test and launch support equipment, as well as mechanical equipment are included. S.S.

N70-34457*# General Electric Co., Philadelphia, Pa. Space Systems Organization.
EARTH RESOURCES TECHNOLOGY SATELLITE SPACECRAFT SYSTEM DESIGN STUDIES. VOLUME 3: PERFORMANCE ASSURANCE Final Report
11 Feb. 1970 204 p
(Contract NAS5-11529)
(NASA-CR-109906; Doc-70SD4207-Vol-3) Avail: CFSTI CSCL 22B

The performance assurance plans for obtaining high spacecraft performance, reliability, and workmanship are presented. The design/development phase, procurement/fabrication phase, and test phase activities are discussed. These include the quality program plan for ERTS A and B, parts plan, materials and processes, configuration management plan, process establishment and control, failure analysis and reporting, compliance of existing hardware to ERTS requirements, and reliability program plan. N.E.N.

N70-34507*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CSM FUEL REQUIREMENTS FOR A LM RESCUE IN LUNAR ORBIT
Ronald W. Simpson 30 Oct. 1967 10 p ref
(NASA-TN-X-64384; MSC-67-EG-29) Avail: CFSTI CSCL 22A

A manned hybrid simulation was conducted to determine the Service Module (SM) RCS fuel requirements for a Lunar Module (LM) rescue in lunar orbit. The objective of the study was to define more fully the CSM consumables requirements, and the effect of a VHF ranging device, in the event that the LM becomes unable to complete the concentric rendezvous sequence following powered ascent from the lunar surface. Only the terminal phase of rendezvous starting at TPI was investigated. The study assumed that the LM had completed the powered ascent, from a 45 E landing site, and insertion into a 10 x 30 nautical mile orbit. It was also assumed the CSI and CDH maneuvers had been made. In the backup (PNGCS failed) mode the ground furnished concentric sequence maneuvers to the CSM, while the TPI and midcourse maneuvers were determined using a line-of-sight rate correction technique developed by the GCD. When VHF ranging information was available in the backup mode, Gemini backup charts were used to determine the maneuvers. The resulting SM-RCS fuel requirements were 418 and 495 pounds for the primary and backup modes, respectively. Author

N70-34508*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Quality Assurance Dept.
SATURN S-4B SYSTEM QUALITY PROGRAM PLAN
1 Jul. 1968 96 p Supersedes SM-41891
(Contract NAS7-101)
(NASA-CR-109940; SM-41891A) Avail: CFSTI CSCL 22D

The Saturn S-4B quality program is described and the material presented defines the organizations which contribute to the quality effort, the responsibilities and contributions of each participating organization, and the means of measuring the effectiveness of the quality program. Author

N70-34512*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PRELIMINARY LUNAR ORBIT ATTITUDE SEQUENCE FOR MISSION F: PROJECT APOLLO
E. C. Howell (TRW Systems Group), C. R. Hunt (TRW Systems Group), and V. W. Simmons (TRW Systems Group) 21 Feb. 1969 58 p refs
(NASA-TM-X-64388; MSC-69-FM-51) Avail: CFSTI CSCL 22C

Both command and service module and lunar module activities are presented based on current mission planning. The lunar orbit attitude sequence is also presented as a sequence of events timeline and a schematic representation of the vehicle attitudes at major event times. The description, in chronological order, of the lunar orbit attitude profile is discussed. Event times for the mission were obtained from the mission F flight plan. Author

N70-34527*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Missile and Space Systems Div.
SATURN S-4B-507 NARRATIVE END ITEM REPORT
W. M. Reitzell Aug. 1968 194 p revised
(Contract NAS7-101)
(NASA-CR-109942; DAC-56622-Rev) Avail: CFSTI CSCL 22D

The report contained herein is a narrative summary of manufacturing and test records relative to the Saturn S-4B-507 Flight Stage. Narrations are included on conditions related to permanent nonconformances which were generated during the manufacturing cycle and existed at the time of acceptance testing. The report sets forth data pertinent to total time or cycle accumulation on time or cycle significant items. Data, relative to variations in flight critical components, are also included. There is no provision to update or revise this volume of the NEIR after initial release. Author

N70-34531*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LM DESCENT/ASCENT SUMMARY DOCUMENT MISSION G PRELIMINARY
Charles O. Lewis, Robert T. Neal, and Muhammed A. Rahman 17 Mar. 1969 62 p refs
(NASA-TM-X-64336; MSC-CF-P-69-16) Avail: CFSTI CSCL 22C

The descent/ascent summary has been prepared to document in detail the crew procedures and supporting information to be used in training for the G Mission. This document covers the mission phase from CSM-LM undocking to touchdown plus two hours, and from preparation for ascent to insertion. Author

N70-34570*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
GENERAL APOLLO SATURN 5 CSM LAUNCH ABORT ANALYSIS: PROJECT APOLLO
Edward M. Henderson 4 Dec. 1968 114 p refs
(NASA-TM-X-64367; MSC-68-FM-232) Avail: CFSTI CSCL 22C

Abort studies were conducted for a typical Apollo spacecraft and a typical Saturn 5 launch vehicle. These data will be representative for launch abort planning for any of the planned Apollo Saturn 5 launches that insert into a near-100-n. mi. altitude circular orbit. Launch abort trajectories for the command and service modules are presented. Specific trajectory data resulting from a launch escape vehicle abort, model 1, are not presented. The data presented shows the effects of variable launch azimuth, corresponding to the lunar launch window, on the various launch abort parameters. The only significant effect of the variable azimuth on the launch aborts are the landing coordinates. The abort trajectory data provides information on abort monitoring, abort maneuver requirements, and abort results. Author

N70-34601*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EVASIVE MANEUVER SUBSEQUENT TO CSM/LM EJECTION FROM THE S-4B IN EARTH ORBIT: PROJECT APOLLO
Michael E. Donahoo and Charles W. Fraley 13 Jun. 1969 81 p refs

(NASA-TM-X-64368; MSC-69-FM-120) Avail: CFSTI CSCL 22A

The analyses conducted which led to the development of the Apollo 9 evasive maneuver subsequent to CSM/LM ejection will be reconstructed step by step to provide an understanding of the final results. This reconstruction can then be used for planning purposes which might arise for future missions. The resultant recommendation precluded recontact between the CSM/LM and S-4B during the actual Apollo 9 mission. The recommended sequence of postejection events also applied to contingencies involving S-4B and service propulsion system ignition failures and covered a range of S-4B vent magnitudes. The recommended sequence also adequately provided for earlier than nominal S-4B ignition in the ascent-to-orbit phase of the mission. Author

N70-34603*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SUMMARY OF SPACECRAFT RANGE SAFETY TRAJECTORY ANALYSES FOR APOLLO MISSIONS: PROJECT APOLLO

Richard E. Kincade 1 Sep. 1967 22 p refs

(NASA-TM-X-64371; MSC-67-FM-129) Avail: CFSTI CSCL 22C

This document summarizes spacecraft range safety trajectory analyses for Apollo missions and the support provided by the manned spacecraft center in order to gain flight plan approval for each mission as required. The basic spacecraft range safety trajectory analyses for each mission have been completed, and any additional studies which may be required will be provided upon request. Author

N70-34608*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

AN ENVELOPE OF SATURN 5 MALFUNCTION TRAJECTORIES WHICH CAN ACHIEVE ORBIT: PROJECT APOLLO

H. G. Schaeffer (TRW Systems Group), V. A. Dulock (TRW Systems Group), and J. J. White (TRW Systems Group) 16 Dec. 1968 28 p refs

(NASA-TM-X-64366; MSC-68-FM-305) Avail: CFSTI CSCL 22C

Abort envelopes which provide an early warning of an impending abort situation are presented for the AS-503/CSM-103 launch trajectory. These abort envelopes represent the limit of the capability of a malfunctioning vehicle to attain a contingency orbit. The envelopes have been constructed so that there is negligible probability of the trajectory penetrating the envelope and then reaching a contingency orbit. The specific malfunctions which were considered in defining the abort envelope are loss of inertial attitude reference, platform gyro drift, first and second stage engine actuator hardover, loss of X-axis accelerometer, failure of second stage engine to ignite, and premature shutdown of first stage engine. Abort limit lines, which represent the combined effects of these failures, are presented for the inertial flight-path angle versus inertial velocity and altitude versus range plotboards. The information presented herein is intended for use during the Apollo 8 launch. Author

N70-34636*# National Aeronautics and Space Administration. Manned Spaceflight Center, Houston, Tex.

DETAILED CREW PROCEDURES FOR POWERED FLIGHT EVALUATION OF THE TRANSLUNAR INJECTION MANEUVER: PROJECT APOLLO

Charles T. Hyle 28 Aug. 1968 32 p refs

(NASA-TM-X-64357; MSC-68-FM-212) Avail: CFSTI CSCL 22A

Detailed procedures to enable the lunar mission flight crew to perform an inflight evaluation of the translunar injection maneuver were defined. Preignition, powered flight, and overspeed evaluation procedures and techniques are discussed and presented in a detailed, flow chart. Undesirable flight conditions which could be induced by S-4B or spacecraft malfunctions are protected against through use of onboard displays and data provided by the ground. In addition to providing required crew safety, a maximum opportunity to obtain a lunar mission is afforded through these techniques. Author

N70-34642*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

MANUAL ABORT MANEUVERS DURING THE TRANSLUNAR COAST PHASE OF A LUNAR MISSION: PROJECT APOLLO

Charles E. Foggatt 21 Nov. 1968 19 p ref

(NASA-TM-X-64379; MSC-68-FM-140) Avail: CFSTI CSCL 22A

A manual abort maneuver was studied for aborts initiated during the translunar coast phase of a lunar mission. The earth viewed through the Apollo docking reticle was used to orient the thrust vector. The results showed that an onboard manual abort capability may exist for a large portion of the translunar coast phase. Author

N70-34645*# National Aeronautics and Space Administration. Manned Spaceflight Center, Houston, Tex.

APOLLO ABORT SUMMARY DOCUMENT MISSION F (AS-506/106) Final Report

Michael R. Wash 3 Feb. 1969 65 p

(NASA-TM-X-64356; MSC-CF-P-69-14) Avail: CFSTI CSCL 22A

The abort summary has been prepared to provide a single reference source of crew procedures and information to be used during Saturn V nominal flight, abort, and abort entry training. The basic document reflects the control procedures to be used by the crew. Appendices supplement the controlled procedures for training purposes and are not under the control of this document. Author

N70-34688*# National Aeronautics and Space Administration. Manned Spaceflight Center, Houston, Tex.

COMPUTER SIMULATION FLIGHT ACCELERATION FACILITY ENTRY MONITORING SYSTEM STUDY: PROJECT APOLLO

Ronald L. Wyrick and Walter R. Russell 19 Mar. 1969 41 p

(NASA-TM-X-64364; MSC-69-EG-15) Avail: CFSTI CSCL 22A

A simplified set of equations was used in a closed loop entry simulation to train the Apollo 8 prime and backup crews. The equations of motion were solved on analog computers, the outputs of which were used as drive signals for the centrifuge. The digital solutions of the simplified equations and the actual piloted data runs verified the equations to be adequate for the purpose of training pilots for lunar entries. The digital verification results of the EMS equations agreed with results obtained from the CSM G&CVS simulation and from an MPAD digital entry simulation. In addition to training the Apollo 8 crews, the simulation was used to demonstrate that safe entries could be made from lunar return velocities using only a meter for an indication of roll angle and an accelerometer as instruments. Author

N70-34688*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

EXCESSIVE ENTRY LOADS FOR ABORT TRAJECTORIES FOR THE NOMINAL AS-206/101 LAUNCH PROFILE

Edward M. Henderson and Alfred N. Lunde 15 Sep. 1967 28 p refs

(NASA-TM-X-64382; MSC-67-FM-132) Avail: CFSTI CSCL 22C

Abort trajectory studies for the nominal AS-206/101 launch trajectory have produced entry load factors (g's) exceeding the established 16-g limitation for aborts initiated from the nominal launch profile. This condition is caused by the steep profile dictated by the 120-n. mi. insertion altitude necessary to achieve the 120/150-n. mi. (perigee altitude to apogee altitude) orbit. The higher altitudes along the launch trajectory tend to pull the g boundary down such that the nominal ascent trace violates the current 16-g limitation. This violation occurs for the current lift-to-drag ratio (L/D) of 0.33. Lowering the L/D increases the g's accordingly but does not cause the violation. As it now stands, current operational procedures would inhibit such a launch. Four methods were investigated in an attempt to alleviate this situation:

(1) reshape the launch profile; (2) raise the 16-g abort limit to 18 g; (3) use the spacecraft propulsion to improve entry conditions; and (4) use the maximum launch vehicle dispersion envelope as the abort guide and fly through the high g region. Author

N70-34678*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TWO-IMPULSE ABORT MANEUVERS FROM A LUNAR MISSION: PROJECT APOLLO
Charles E. Foggett 18 Aug. 1966 16 p refs
(NASA-TM-X-64395; MSC-66-FM-82) Avail: CFSTI CSCL 22A

The possibilities were investigated of reducing the trip time from abort to landing on a lunar mission by employing a two-impulse abort maneuver rather than the normal one-impulse abort. The only abort mode investigated is the time-critical abort to an unspecified landing area. The results show that the return time can be considerably reduced in many cases when the two-impulse abort maneuver is performed as compared to the return time of a one-impulse abort. Author

N70-34680*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RENDEZVOUS PROCEDURES D MISSION AS-504/CSM-104/LM-3 Final Report
Stephen P. Grega and Milton C. Contella 31 Jan. 1969 66 p refs revised
(NASA-TM-X-64363) Avail: CFSTI CSCL 22A

The primary procedures for the LM-3 active rendezvous with CSM-104 spacecraft are presented. The single source of procedures provides information for use in flight planning, crew training, and preparation of onboard data. Author

N70-34683*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SATURN S-4B-510 NARRATIVE END ITEM REPORT
W. M. Reitzell Jul. 1969 217 p refs
(Contract NAS7-101)
(NASA-CR-109939; DAC-56725) Avail: CFSTI CSCL 22D

A narrative summary of test records relative to the Saturn S-4B-510 flight stage is presented. Narrations are included on those conditions related to permanent nonconformances which were generated during the manufacturing cycle and existed at the time of Space Systems Center acceptance testing. The report sets forth data pertinent to total time or cycle accumulation on time or cycle significant items. Data relative to variations in flight critical components are also included. Author

N70-34701*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MISSION PLANNING STUDIES FOR MANNED, CIRCULAR, SYNCHRONOUS-ORBIT MISSIONS: PROJECT APOLLO
Charles T. Hyle 23 Sep. 1966 85 p refs
(NASA-TM-X-64402; MSC-66-FM-104) Avail: CFSTI CSCL 22A

General mission planning information, such as payload capability, deorbit requirements, and hardware characteristics, was investigated for manned, circular, synchronous-orbit missions for the Apollo Applications Program. Four circular, synchronous-orbit missions were investigated in detail. Two of these missions were equatorial and two were inclined. The results showed that the Saturn 5 designed for the lunar mission could place 39, 543 lb of payload into the equatorial orbits and 71, 360 lb of payload into the inclined orbits. Because it is so small, the payload for an equatorial mission could not include a lunar module laboratory. Author

N70-34707*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RENDEZVOUS PROCEDURES: APOLLO 7, AS-205/101 Final Report
Duane K. Mosel 27 Sep. 1968 60 p refs revised
(NASA-TM-X-64411; MSC-CF-P-68-19-Rev-A) Avail: CFSTI CSCL 22A

The primary and backup crew procedures are presented for the CSM 101 spacecraft rendezvous with the AS-205 S-IVB stage. The Rendezvous Procedures Document provides a single source of procedures information for use in flight planning, crew training, and preparation of onboard data. Author

N70-34709*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PRELIMINARY CONTINGENCY PROCEDURES FOR THE LUNAR ORBIT INSERTION, LUNAR ORBIT, AND TRANSEARTH INJECTION PHASES OF THE LUNAR MISSION
Samuel R. Newman and Charles E. Foggett 22 Aug. 1968 35 p refs
(NASA-TM-X-64358; MSC-68-FM-211) Avail: CFSTI CSCL 22C

The preliminary contingency ground rules and procedures are presented for the lunar orbit, and transearth injection phases of the lunar mission. A flow chart of the CM, LM and related MCC-H activities is included and identifies the command module computer and LM guidance computer programs required during these contingencies. In order to provide a more complete discussion of the abort techniques, the abort procedures following a complete communications failure (CM and LM) is presented. Author

N70-34711*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO MISSION F PERFORMANCE ANALYSIS OF RENDEZVOUS CHARTS
Robert K. Buell and John Hutchins 29 Apr. 1969 38 p
(NASA-TM-X-64405; MSC-CF-R-69-20) Avail: CFSTI CSCL 22A

A digital analysis of the F Mission backup rendezvous charts has been performed to verify their ability to predict CSI, CDH, TPI, and midcourse corrections in the presence of system and application errors and trajectory dispersions. The charts simulated were those from the LM 4 onboard data package. The mission situation simulated represented the PNGS inoperative, rendezvous radar information available from the tapemeter, attitude data from the AGS and control by the CES. The study showed that the standard deviation of the arrival time at TPI was 4.45 minutes. If no braking or line-of-sight control was executed after the second midcourse correction, the mean miss distance would have been 0.27 NM with a standard deviation of .41 NM. The mean total translational delta V required after insertion was 150.5 ft/sec with a standard deviation of 21.0 ft/sec. Author

N70-34713*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DYNAMIC TESTING OF APOLLO SPACECRAFT IN THE FLIGHT ENVIRONMENT (STROKING TEST): PROJECT APOLLO
William H. Peters 31 Dec. 1968 19 p refs
(NASA-TM-X-64354; MSC-68-EG-19) Avail: CFSTI CSCL 22B

The concept of an inflight stroking test is simple, inexpensive, easy to perform, and provides significant benefit in the development of an aerospace vehicle. The Apollo test consists of commanding the engine gimbal pitch actuator at a constant rate for a short time, reversing polarity of the drive command for another period of time, etc., to form a series of ramp inputs. This note describes the stroking test that is scheduled to be performed on Apollo (Mission D). It provides: (1) a justification for the test; (2) procedures and criteria; (3) an account of preflight analysis performed; and (4) the postflight analysis plan. Author

N70-34714*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO PAD ABORT LAND IMPACT TESTS AT KENNEDY SPACE CENTER
Terrance G. Reese and J. David Rosen 16 Apr. 1969 51 p

Program Apollo Working Paper No. 1344
(NASA-TM-X-64365) Avail: CFSTI CSCL 22D

Present concepts rule that all Apollo flights terminate with landing on water. However, land landing is a possibility if Apollo flights are aborted within 40 seconds of launch. A drop-test program was initiated to define the severity of command module landings within the potential land-landing area. A portable drop-test rig was designed and a full-scale, rigid model of the Apollo command module was instrumented to provide center-of-gravity impact acceleration data. A field survey was undertaken to identify soil and vegetation types within the abort area, and representative sites were chosen for the tests. Impact conditions were selected to subject the test vehicle to the most severe landings possible. Pertinent test data in unfiltered form are presented in this report with descriptions of test apparatus, test sites, and test operations. A preliminary evaluation of the acceleration data indicates that peak impact accelerations encountered in the tests were within human-tolerance levels. Author

N70-34718*# National Aeronautics and Space Administration. Manned Spaceflight Center, Houston, Tex.
CSM RENDEZVOUS PROCEDURES: G MISSION Final Report
23 Jun. 1969 167 p refs revised
(NASA-TM-X-64412; MSC-CF-P-69-11-Rev-A) Avail: CFSTI CSCL 22A

The nominal Guidance, Navigation, and Control System crew procedures for the CSM-107 spacecraft which will be the target vehicle for the LM-5 active lunar orbit rendezvous are presented. The procedures are given in the form of an onboard rendezvous checklists for fifteen LM rescue and abort cases. The purpose of the CSM Rendezvous Procedures document is to provide a single source of procedures information for use in flight planning, in crew training, and in preparing onboard data. Author

N70-34723*# National Aeronautics and Space Administration. Manned Spaceflight Center, Houston, Tex.
LM RENDEZVOUS PROCEDURES: G MISSION, AS-506/CSM-107/LM-5 Final Report
Stephen P. Grega 16 May 1969 65 p refs
(NASA-TM-X-64410; MSC-CF-R-69-23) Avail: CFSTI CSCL 22A

The primary procedures for the LM-5 active rendezvous with CSM-107 spacecraft are presented. The purpose of the LM Rendezvous Procedures document is to provide a single source of procedures information for use in flight planning, in crew training, and in preparing onboard data. Author

N70-34724*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houstin, Tex.
LM RENDEZVOUS PROCEDURES: F MISSION, AS-506/CSM-106/LM-4 Final Report
John E. Hutchins and John C. Axford 20 Apr. 1969 34 p revised
(NASA-TM-X-64407; MSC-CF-R-69-12-Rev-A) Avail: CFSTI CSCL 22A

The primary procedures are presented for the post-phasing-maneuver portion of the LM-4 active rendezvous with the CSM-106 spacecraft and is based on data obtained from the Mission Planning and Analysis Division on April 4, 1969, concerning a May 18, 1969, launch trajectory. The purpose of the Rendezvous Procedures Document is to provide a single source of procedures information for use in flight planning, crew training, and preparation of onboard data. Author

N70-34728*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houton, Tex.
APOLLO MISSION D PERFORMANCE ANALYSIS OF RENDEZVOUS CHARTS
Larry B. Mc Whorter and John E. Hutchins 22 Jan. 1969 37 p refs
(NASA-TM-X-64377; MSC-CF-R-69-3) Avail: CFSTI CSCL 22A

A digital analysis of the D Mission backup rendezvous charts was performed to verify their ability to predict CSI, CDH, TPI, and midcourse corrections in the presence of system and application errors and trajectory dispersions. The charts simulated were those from the LM 3 onboard data package. The mission situation simulated represented the PNGS inoperative, rendezvous radar information available from the tapemeter, attitude data from the AGS and control by the CES. The study showed that the standard deviation of the arrival time at TPI was 5.5 minutes. The mean change in time from TPI to intercept with braking and line-of-sight control was 35.8 minutes with a standard deviation of 1.5 minutes. If no braking or line-of-sight control was executed after the second midcourse correction, the mean miss distance would have been 0.6 n.mi. with a standard deviation of .35 n.mi. The mean total translational change in velocity required after insertion was 158 ft/sec with a standard deviation of 20 ft/sec. Author

N70-34730*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EVALUATION OF MANNED SPACECRAFT PRELAUNCH CHECKOUT
Tommie L. Wheeler and Edgar A. Dalke [1969] 32 p
(NASA-TM-X-64372; MSC-EB-R-69-10) Avail: CFSTI CSCL 22D

The results of a program to define the needs of a next generation spacecraft checkout system are presented and include: (1) a basic system analysis of the present Acceptance Checkout Equipment (ACE) system; (2) an identification of the recognized ACE capabilities; (3) an outline of some of the more pertinent requirements for a new system; (4) a description of one of the evaluation tools; (5) a definition of a new system organization; and (6) a detailed discussion of the present work activity. D.L.G.

N70-34733*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO RANGE SAFETY DESTRUCT TIME DECAY, SATURN 1B AND SATURN 5
Charles Teixeira 26 Jan. 1965 55 p refs Program Apollo Working Paper No. 1161
(NASA-TM-X-64361) Avail: CFSTI CSCL 22D

Range safety destruct action on a Saturn launch vehicle must allow for a safe abort by the crew. The time delay required between arming of the destruct system and the time at which destruct action can be commanded by the range safety officer is 3.27 seconds for the Saturn 1B and 4.10 seconds for the Saturn 5. The study was limited to launch escape system aborts from nominal launch vehicle trajectories and altitudes from the pad to 40,000 feet. This altitude range carried the launch vehicle over water and into the high q region. Further studies are being performed to determine if aborts at off-nominal flight conditions have a significant effect on the required time delays. Service module aborts will also be studied to determine the delay time(s) required for this abort mode. Pending the results of these additional studies, the above time delays are recommended as the minimum fixed time delays for the atmospheric portion of the launch trajectory. Author

N70-34740*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO CSM RCS DAP PROPELLANT STUDIES:
Edward T. Kubiak 9 Sep. 1968 10 p refs
(NASA-TM-X-64408; MSC-68-EG-11) Avail: CFSTI CSCL 22A

The RCS propellant usage studies for the Apollo CSM, primary control system, have been made to update data used in propellant calculations, and to determine the propellant penalty caused by inexact inertia values in the CMC. These results are presented and the digital simulation used in the study is described. Briefly, the results indicate that previously used RCS propellant

consumption rate data was low for single-axis automatic maneuvers. Also, it is shown that computer values of inertia in error by more than 25 percent can cause a sizable (20 percent or higher) propellant penalty for automatic maneuvers. Author

N70-34744*# National Aeronautics and Space Administration. Manned Spaceflight Center, Houston, Tex.
DIGITAL ANALYSIS OF LM TERMINAL PHASE BACKUP CHARTS
Larry B. Mc Whorter 22 May 1968 33 p
(NASA-TM-X-64378; MSC-CF-R-68-18) Avail: CFSTI CSCL 22A

A digital analysis of the LM terminal phase rendezvous charts was performed to verify their in-plane accuracy and performance in the presence of system and application errors. This analysis indicated that the theoretical performance was about 1.05 times the two impulse theoretical minimum using the constraints of 2120 second transfer time and elevation of the target line-of-sight above the local horizontal of 26.8 deg at TPI. With system errors and application errors included the translation fuel required was about 1.4 times theoretical minimum. With no line-of-sight control of braking these errors resulted in a mean-miss distance of approximately 1235 feet. Author

N70-34768*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RESULTS OF SIMULATION OF LM RENDEZVOUS USING GRAPHICAL CHARTS
John E. Hutchins 8 Feb. 1968 29 p
(NASA-TM-X-64339; MSC-CF-R-68-1) Avail: CFSTI CSCL 22A

A man-in-the-loop simulation study of LM terminal phase rendezvous in earth orbit was conducted on the lunar module procedures simulator to establish the adequacy of graphical rendezvous charts as a backup and monitor of the PGNS and AGS. A total of 30 runs were made with 6 sets of initial conditions starting approximately 14 minutes prior to terminal phase initiation, and ending after establishing formation flying at a range of 50 to 100 feet. The resulting data indicated the mean propellant quantity required to accomplish a 15 n.mi delta h rendezvous from below to be 126.8 pounds, with a maximum propellant requirement of 150.3 pounds and a minimum of 112.1 pounds. Assuming a statistically normal distribution of propellant resulted in a computed standard deviatinn of 15.5 pounds in the total propellant used. Author

N70-34791*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ANALYSIS OF TERMINAL PHASE RENDEZVOUS LIGHTING: PROJECT APOLLO
Milton C. Contella 5 Mar. 1969 15 p ref
(NASA-TM-X-64404; MSC-CF-R-69-6) Avail: CFSTI CSCL 22A

An analysis of the lighting problems associated with terminal phase rendezvous in both earth and lunar orbit has been made to define time limits on the Terminal Phase Initiation (TPI) maneuver. The study is limited to the nominal LM rendezvous from below with CSM rescue from above. Author

N70-34793*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SATURN S-4B-504N STAGE FLIGHT EVALUATION REPORT
May 1969 701 p refs
(Contract NAS7-101)
(NASA-CR-109941; SM-47007) Avail: CFSTI HC $10.00/MF $0.65 CSCL 22D

Results of the prelaunch countdown, powered flight, and orbital phases of the S-4B-504N stage launched 3 March 1969 as the third stage of the Saturn AS-504 vehicle are evaluated. Systems analyses are also summarized in tabular and graphic representations for engine, fuel, oxygen-hydrogen burn, auxiliary propellant, data acquisition, pneumatic control, electric power and control, hydraulic, and forward skirt thermoconditioning systems. J.A.M.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-33410# National Reserach Council of Canada, Ottawa (Ontario).
THE FREE VIBRATIONS OF AN ELASTICALLY MOUNTED RIGID BODY
E. Kosko Feb. 1970 155 p refs
(LTR-ST-389) Avail: CFSTI

Frequency equations are set up and solved for the free vibrations of a rigid body mounted on an elastic suspension. Several special cases, as well as the most general case, are considered in detail. Results are presented in the form of directly applicable formulae, graphs and charts. The special cases include plane vibrations with simple and with double coupling, anti-plane vibrations, vibrations of axially oriented and of the concentric systems. Particular attention is given to the normal modes of vibration, and some simple graphical constructions are described which help visualize these modes. Numerical examples illustrate the application of the formulae. The effects of damping in this type of system are also considered. Author

N70-33439# National Aeronautical Establishment, Ottawa (Ontario). Structures and Materials Section.
APPLICATION OF THE HIGH PRECISION TRIANGULAR PLATE-BENDING ELEMENT TO PROBLEMS WITH CURVED BOUNDARIES
M. W. Chernuka, G. R. Cowper, G. M. Lindberg and M. D. Olson Oct. 1969 58 p refs
(NRC-11274; LR-529) Avail: CFSTI

The application of the high precision triangular plate-bending element to problems with curved boundaries is considered. Appropriate edge conditions for nodal points on these boundaries are derived. The error inherent in representing a curved boundary by a series of straight segments is found to be the limiting factor on accuracy, while the effect of approximations in the boundary conditions is minor. To overcome the first type of error, the high precision element is modified to include one curved edge. Substantial improvements in accuracy are obtained, as demonstrated in example calculations for circular and elliptical plates. Author

N70-33469# McGill Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
CYLINDRICAL FINITE ELEMENTS FOR ANALYSIS OF CYLINDRICAL STRUCTURES
Apuni A. Lakis Nov. 1969 147 p refs
(MERL-70-2) Avail: CFSTI

Initial accomplishments are reported in a program aimed at the study of vibration of non-uniform thin cylindrical shells subjected to unsymmetrical static and dynamic pressure forces, by means of the finite element method. The first phase of the program dealt with the establishment of a suitable finite element and the derivation of the stiffness, mass, and stress resultant matrices for the element. The finite element chosen was a cylindrical frustum, rather than the more usual triangular or rectangular flat plate

elements, thereby allowing the use of the thin shell equations in full for determining the displacement functions and the matrices. Computer programs were written for constructing the stiffness, mass, and stress resultant matrices in terms of only geometric and material properties of the shell. Author

N70-33607# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
A METHOD FOR CALCULATION OF FREQUENCIES AND MODES USING AN IMPROVED INERTIA MATRIX
S. Durvasula, P. Bhatia, K. Kalyana Raman, and S. S. Jagirdar Jun. 1970 36 p refs Presented at 21st Annual Gen. Meeting of the Aeron. Soc. of India, Madras, 4-6 Apr. 1969
(AE-276-S) Avail: CFSTI

A method of obtaining an improved mass matrix in a discrete approximation of a continuous elastic system is outlined. The modified mass matrix is constructed by using an appropriate displacement distribution over the entire structure and expressing the kinetic energy in terms of the velocities of the grid points and constitutes a distinct improvement on the simple lumped mass method widely used in practice. The improvement that is possible in the determination of natural frequencies and mode shapes by the use of this modified mass matrix together with the measured flexibility matrix over the normal practice of using the diagonal lumped mass matrix and measured flexibility matrix is demonstrated with respect to a few representative examples. Author

N70-33640# Massachusetts Univ., Amherst. School of Engineering.
IMPACT LOADING OF SUBMARINE HULLS
Frederick J. Dzialo Feb. 1970 57 p refs
(Contract N00014-68-A-0146; Proj. Themis)
(AD-705525; THEMIS-UM-70-2) AVAIL: CFSTI CSCL 13/10

Following Flugges exact derivation for the buckling of cylindrical shells, the equations of motion for dynamic loading of cylindrical shells subjected to hydrostatic and axial pressure have been formulated. The equations of motion are applicable for long, short, or thick shells, and are very useful in calculating deflections and stresses when the impact loads are applied to comparatively small regions of the shell. The normal mode theory was utilized to provide dynamic solutions for the equations of motion. Solutions are also provided for the Timoshenko-type theory, and comparisons are made between the two theories by considering and neglecting in-plane inertia forces. Comparison of results is exemplified by a numerical example which considers the effect of hydrostatic pressure on the dynamic response of a shell simply supported by a thin diaphragm and subjected to a localized unit radial impulse. Author (TAB)

N70-33652# National Research Council of Canada, Ottawa (Ontario). Structures and Materials Lab.
NEW DEVELOPMENTS IN THE FINITE ELEMENT ANALYSIS OF SHELLS
G. M. Lindberg, M. D. Olson, and G. R. Cowper *In its* The Div. of Mech. Eng. and the Natl. Aeron. Estab. 31 Dec. 1969 p 1-38 refs (See N70-33651 18-34)
Avail: CFSTI

A finite triangular-curved-shell element method for the analysis of general shell structures is investigated. It is shown to be efficient in yielding displacement and stress predictions for shallow shells. The methodology for application to deep shells is developed and tested with numerical applications. Numerical results for various shell geometries are included. F.O.S.

N70-33682# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
ON THE QUESTION OF LIFE PREDICTION FOR CIRCULAR NOTCHED ROUND STEEL PROBES UNDER REPEATED PULL-PRESSURE STRESS [ZUR FRAGE DER LEBENSDAUERVORHERSAGE UMLAUFEND GEKERBTERSTAHLRUNDPROBEN UNTER WIEDERHOLTER ZUG-DRUCKBEANSPRUCHUNG]
Ludwig Bertele (Ph.D. Thesis) 26 Jan. 1970 132 p refs In GERMAN
Avail: CFSTI

Experimental studies were performed in order to verify the application of the micro- and macro support theory for predicting fatigue life of smooth and circular notched round steel samples subjected to vibrational stress. Pull-pressure fatigue tests at constant and varying stress-strain amplitudes show that the above described theory is able to predict fatigue life at concentrated stress. Transl. by G.G.

N70-33724# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SIMULATION OF RANDOM LOAD FATIGUE IN LABORATORY TESTING
T. J. Ravishankar Mar. 1970 109 p refs
(UTIAS-29) Avail: CFSTI

The methods used in laboratory simulation of random service load conditions, that lead in practice to fatigue failure if e.g. aircraft structures, are reviewed. First, the interrelation of the atmospheric turbulence with the resulting loads on the aircraft are discussed. Then follows an analysis and interpretation of service load histories and a review and comparison of the methods in use for simulating service load spectra of arbitrary and random load sequences. Both random loading, using discrete load levels or analogous random process testing, are discussed. Full scale testing is also reviewed. In appendices, stationary random processes and fewer spectral density functions an evaluation of probability distributions of RMS gust velocities and some damage theories are presented. Author

N70-33732# Aerospace Corp., San Bernardino, Calif.
BANDWIDTH MINIMIZATION OF STIFFNESS MATRICES Technical Report, Nov. 1969 - Feb. 1970
James G. Crose 12 May 1970 15 p refs
(Contract 04701-69-C-0066)
(AD-705579; TR-0066(S5816-53)-1; SAMSO-TR-70-167) Avail: CFSTI CSCL 20/11

A finite element analysis method can be developed for asymmetrically loaded axisymmetric solids by expanding the variables in the circumferential direction with a Fourier series approximation. It is shown that the resulting stiffness matrix can be banded, resulting in considerable savings in computer storage and time. Also, it is shown that, in order to achieve the minimum bandwidth, different approaches are required depending on whether the harmonics couple or uncouple. The two stiffness matrix formulations are described. Author (TAB)

N70-33796# Defense Documentation Center, Alexandria, Va.
PRESSURE VESSELS, VOLUME 1 A DDC BIBLIOGRAPHY, Jan. 1963 - Jun. 1969
Mar. 1970 118 p refs
(AD-702600; DDC-TAS-70-22-I) Avail: CFSTI CSCL 13/4

The annotated bibliography comprises citations of unclassified reports dealing with tests and applications of pressure vessels used for tanks (containers) submarine hulls, rocket cases, ramjet engines and guided missiles. Author

N70-33873# National Materials Advisory Board, Washington, D.C. Div. of Engineering.
AN APPROACH FOR SYSTEMATIC EVALUATION OF MATERIALS FOR STRUCTURAL APPLICATION Final Report
Feb. 1970 63 p
(Contract DA-49-083-OSA-3131)
(AD-705684; NMAB-248) Avail: CFSTI CSCL 13/3

An approach is discussed which will enable the Services, the producers and materials engineers to decide upon the type of material evaluation tests which need to be performed for the

purposes of obtaining screening, selection and design data. The necessary tests are indicated by a system which takes into account the system, vehicle, component, environment, and operational criteria. The system is based upon the preparation of a large number of applications case histories, the data from which must be recorded according to a rigid format. The compilation of the case histories makes up what is called the Applications Analysis Data Bank. The system can be coded so that the case history data can be computer-analyzed to answer a number of pertinent questions for which answers are not easily obtainable at present. A complete materials evaluation system will consist of three data banks: (1) Applications Analysis, (2) Material Properties (these now exist), and (3) Material Evaluation Techniques. Examples are shown to demonstrate the workings of the proposed system and the many types of questions which can be answered. The necessary steps for the further development of the system are recommended. Author (TAB)

N70-33886# Liege Univ. (Belgium). Lab. de Techniques Aeronautiques et Spatiales.

STABILITY ANALYSIS BY FINITE ELEMENTS Technical Report, 1 Apr. – 30 Jun. 1969

Baudouin M. Fraeijs de Veubeke and A. P. Kabaila Wright-Patterson AFB, Ohio AF Flight Dyn. Lab. Mar. 1970 32 p refs

(Contract F61052-69-C-0004)

(AD-705629; SA-16; AFFDL-TR-70-35) Avail: CFSTI CSCL 20/11

The application of finite elements to the analysis of structural stability problems is examined. A variational criterion for stability, namely the criterion that for stable equilibrium the second variation of the total energy must be positive definite, is used to develop a quadrilateral plate element, as well as an element for a prismatic member. The theory is presented in such a form that other elements can be derived therefrom with ease. Author (TAB)

N70-33889*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

ASSESSMENT OF SPACE VEHICLE AEROACOUSTIC-VIBRATION PREDICTION, DESIGN, AND TESTING

Harry Himelblau (North Am. Rockwell Corp.), C. Myron Fuller, and Terry D. Scharton (Bolt, Beranek and Newman, Inc.) Washington NASA Jul. 1970 134 p refs

(Contract NAS1-6024)

(NASA-CR-1596) Avail: CFSTI CSCL 20K

A general survey of the field of space-vehicle structural vibration, which is induced by acoustic and aerodynamic noise and certain mechanical excitation is provided. The fundamental sources and mechanisms of the vibration are identified; analytical methods of vibration prediction are described. Laboratory, field, and flight testing are discussed, including problems of qualification and acceptance test selection. A list of program objectives is furnished outlining a general procedure for ensuring the structural integrity and operational performance of launch vehicles and spacecraft exposed to structural vibration. Then, to ensure that these objectives are satisfied, general recommendations are made for implementing the various design, analysis, and testing techniques during various phases of vehicle development. Author

N70-33890# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.

A STUDY OF WEAKLY NONLINEAR DYNAMICAL SYSTEMS AND THEIR STABILITY Interim Technical Report, 16 Sep. 1968 – 15 Sep. 1969

P. R. Stehna Apr. 1970 4 p

(Grant AF-AFOSR-0704-68B)

(AD-705659; AFOSR-70-1100TR) Avail: CFSTI CSCL 20/11

Previously obtained mathematical results for the nonlocal behavior of dynamical systems have now been extended and applied to problems of physical interest. With the help of these results detailed study can now be made of large motions in the interior of vehicles undergoing high frequency vibrations. Other applications pertain to the study of semi-infinite domain attraction of almost periodic oscillations in systems performing monofrequency motions. Furthermore, new and simpler methods of analysis have been developed obtaining results more general than those of the standard method of averaging for systems with fast and slow time. Author (TAB)

N70-33916# Liege Univ. (Belgium). Lab. de Techniques Aeronautiques et Spatiales.

LARGE DISPLACEMENT FORMULATION FOR ELASTIC BODIES Technical Report, 1 Apr. – 30 Jun. 1969

Baudouin M. Fraeijs de Veubeke Wright-Patterson AFB, Ohio AF Flight Dyn. Lab. Mar. 1970 41 p

(Contract F61052-69-C-0004)

(AD-705628; SA-15; AFFDL-TR-70-34) Avail: CFSTI CSCL 20/11

The report discusses the strain measures for large displacements in both lagrangian and eulerian variables. Similarly, relations are established between lagrangian and eulerian variations of fields with a view to construct eulerian variational principles from the known lagrangian principle of (large) displacements. Various definitions of stress tensors are also discussed and related. Author (TAB)

N70-33942# Brown Univ., Providence, R.I. Div. of Applied Mathematics.

ON MINIMIZING THE RESPONSE OF STRUCTURES TO DYNAMIC LOADING

Raymond H. Plaut 1969 16 p refs

(Contract N00014-67-A-0191-0009)

(AD-705518) Avail: CFSTI CSCL 13/13

The response of elastic beams to general distributed dynamic loading is considered. A bound on the displacement of the beam is derived, and the design which minimizes this response bound is determined for some particular cases and is compared to the optimal design for minimum deflection under static loading. Author (TAB)

N70-33964# Sandia Corp., Albuquerque, N.Mex.

DYNAMIC BUCKLING OF ELASTIC-PLASTIC SHALLOW ARCHES

Ivor K. Mc Ivor and H. Donald Fisher 1969 56 p refs Presented at the Am. Soc. of Civil Engr. Conf., Portland, Oreg.

(SC-DC-70-4809; Conf-700405-1) Avail: CFSTI

The dynamic snap-through of simply supported and clamped, shallow, circular arches composed of an elastic-linear strain hardening material is investigated. With the arch semiopening angle serving as the identifying parameter for a family of curves, the results of the study are summarized in a plot of critical impulse (the impulse required to produce plastic snap-through, versus radius to thickness ratio). For selected geometries, the midspan deflection, and the dimensionless membrane stress resultant as computed by the modal analysis and a finite difference solution are compared graphically. Author

N70-34004*# North American Rockwell Corp., Los Angeles, Calif.

XB-70 STRUCTURAL MODE CONTROL SYSTEM DESIGN AND PERFORMANCE ANALYSES

John H. Wykes, Louis U. Nardi, and Alva S. Mori Washington NASA Jul. 1970 163 p refs

(Contract NAS4-1175)

(NASA-CR-1557) Avail: CFSTI CSCL 20K

A system to suppress the structural motion of flexible airframe was designed for installation and flight test on the XB-70 airplane. The system was constrained to controlling only the symmetric structural modes using the existing elevons as force generators. The

minimum-change design operates through the existing pitch augmentation servo. Analytical evaluation shows that the system is stable and effective in controlling motion of the first three structural modes without degrading basic handling qualities. Author

N70-34057# Naval Postgraduate School, Monterey, Calif.
OPTIMAL DESIGN OF TRUSSED STRUCTURES
William Arthur Crockett (M.S. Thesis) Oct. 1969 50 p refs
(AD-705093) Avail: CFSTI CSCL 13/13

Structural design problems can be considered to be optimization problems because a design is sought which is optimal by some criterion subject to limitations on size, behavior, or other aspects of the structure. Under certain conditions, such problems may be solved by conventional mathematical programming techniques. The minimum weight design of a statically indeterminate three-bar truss is used to illustrate the application of the sequential unconstrained minimization technique of Fiacco and McCormick to the optimal design of trussed structures. A suggested computational procedure and computer program are included. Author (TAB)

N70-34066# Naval Ordnance Lab., White Oak, Md.
A STUDY OF HERTZIAN IMPACT ON GLASS AND ALUMINUM HEMISPHERICAL SHELLS WITH MITIGATOR
Jackson C. S. Yang and James R. Camper (Naval Acad.) 5 Sep. 1969 28 p refs
(AD-705997; NOLTR-70-11) Avail: CFSTI CSCL 13/10

Hertzian impact theory and a solution published by E. Reissner for an unrestrained shallow spherical shell are used to find total stress on the inner surface of a hemispherical shell covered by a viscoelastic mitigator. From data obtained by experimental means and published references, it is concluded that Hertzian impact theory is valid for certain type shells as well as solid bodies and that a mitigator will effectively reduce stresses in an impacted shell. Author (TAB)

N70-34089# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OSCILLATIONS OF BLADES WITH A Z-SHAPED JOINT
V. N. Makarov 2 Sep. 1969 9 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 14, no. 3, 1968 p 40–41
(AD-703157; FTD-HT-23-1255-68) Avail: CFSTI CSCL 21/5

Natural oscillations of nontwisted turbine blades with constant cross section and closed with a Z-type joint are studied. The origin of the coordinates is assumed to be at the center of gravity in the lower section of the blade, with the X-axis running longitudinally along the blade, and the Y and Z axes coinciding with the axes of the maximum and minimum moments of inertia. The analytical results indicate that the oscillation represents a combination of bending and torsional oscillations, which depend on the type of joint in the channel. Author (TAB)

N70-34079# Naval Ship Research and Development Center, Washington, D.C.
STATIC STRESS MEASUREMENTS ON A HIGHLY-SKEWED PROPELLER BLADE Final Report
Robert J. Boswell Dec. 1969 15 p refs
(AD-702726; NSRDC-3247) Avail: CFSTI CSCL 13/10

Static stresses were measured in a highly skewed marine propeller blade using a specially constructed pressure chamber which allowed the blade to be loaded under air pressure. The measured stress distribution was radically different from those previously measured on unskewed blades. The highest stresses occurred in a relatively narrow band extending from near the trailing edge at the blade root to near the leading edge at 90-percent radius. For a uniform pressure loading of 1.0 psi, the maximum measured principal stress was 2200 psi in compression and 1800 psi in tension. The maximum radial stress calculated by beam theory for the equivalent unskewed propeller was 910 psi both in tension and compression. Author (TAB)

N70-34084# California Univ., Berkeley. Structural Engineering Lab.
STRESS ANALYSIS OF AXISYMMETRIC SOLIDS UTILIZING HIGHER-ORDER QUADRILATERAL FINITE ELEMENTS
William P. Doherty, Edward L. Wilson, and Robert L. Taylor Jan. 1969 103 p refs
(PB-190321; SESM-69-3) Avail: CFSTI CSCL 13M

The finite element method was applied to the determination of displacements and stresses within axisymmetric and plane solids with orthotropic, temperature dependent material properties. A new element was developed with greatly improved bending characteristics. The continuous body is idealized by a system of ring elements of triangular or quadrilateral cross section. Since elements are of arbitrary shape and may be applied to structures composed of many different materials of complex geometry. The analysis is used as the basis for the development of a general computer program which is capable of performing a thermal stress analysis of reentry vehicle nose tips as well as many other plane or axisymmetric structures. Nodal point and element data generation options allow the program to be readily used. A complete FORTRAN 4 listing of the computer program is given. Author

N70-34142# Politecnico di Torino (Italy). Ist di Costruzioni Aeronautiche.
ON THE BEHAVIOR OF JUNCTIONS IN AXISYMMETRICAL RESERVOIRS [SUL COMPORTAMENTO DEI RACCORDI NEI SERBATOI ASSIALSIMMETRICI]
Giuseppe Surace 1968 51 p refs In ITALIAN *Its* No. 15

Axisymmetrical thin junctions in elastic shells of small and great curvature are examined. After treating the behavior problem theoretically, and reviewing available data, expressions are developed for rapid calculation of the influence coefficients.
Transl. by F.O.S.

N70-34145# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
A NOTE ON POST-BUCKLING SOLUTION OF ELASTIC STRUCTURES
Pin Tong Jan. 1970 27 p refs
(Contract F44620-67-C-0019)
(AD-705260; ASRL-TR-144-4; AFOSR-70-0666TR) Avail: CFSTI CSCL 13/13

An approach to the postbuckling solution which differs slightly from that of Koiter is presented. Application to a problem with a non-linear prebuckling solution is also given. Author (TAB)

N70-34164 National Lending Library for Science and Technology, Boston Spa (England).
CRITICAL LOADS IN REGIONS WEAKENED BY HOLES WITH CRACKS [O KRITICHESKIKH NAGRUZKAKH DLYA OBLASTEY OSLABLENNYKH OTVERSTIYAMI S TRESCHINAMI]
A. A. Kaminskii Apr. 1970 10 p refs Transl. into ENGLISH from Kontsentratsiya Napryazh. (USSR), v. 1, 1965 p 130–136
(NLL-RTS-5663) Avail: Natl. Lending Library, Boston Spa Engl.: 17s 6d or 2 NLL photocopy coupons

The problem of determining the critical load in uniaxial tension for a thin infinite plate weakened by an arbitrary elliptical hole with two equal macroscopic equilibrium cracks of length is discussed. Author

N70-34173# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
INTERACTION BETWEEN AXISYMMETRIC AND NONSYMMETRIC CREEP BUCKLING OF CIRCULAR CYLINDRICAL SHELLS IN AXIAL COMPRESSION
Ilan M. Levi and Nicholas J. Hoff Jan. 1970 73 p refs
(Contract F44620-69-C-0009)

(AD-705604; SUDAAR-388; AFOSR-70-0285TR) Avail: CFSTI CSCL 20/11

The purpose of the investigation described in this paper is the study of the effect of very small nonaxisymmetric initial deviations from the exact shape upon the deformations and the critical time of a thin-walled circular cylindrical shell which was manufactured with larger initial deviations of an axisymmetric type. The calculations are carried out in a manner similar to that of a recent paper by the senior author. It is assumed that all the deformations are due to nonlinear steady creep governed by Odqvists law. In consequence of the nonlinearity of the constitutive equation and the use of three terms in the expressions for the deformations and the stresses the trigonometric calculations become so complicated that they must be carried out by means of the high-speed digital computer. For this purpose use is made of the REDUCE program. It is found that in a particular case the critical time of the shell is reduced to about one-half the original value when one adds to the small axially symmetric component of the initial deviations a nonaxisymmetric component which is ten orders of magnitude smaller. The reduction in critical time is represented by a factor of about 1/15 when the amplitudes of the axisymmetric and nonaxisymmetric initial deviations are equal. Author (TAB)

N70-34181# Watervliet Arsenal, N.Y.

FREE VIBRATIONS OF A CIRCULAR ROD WITH AN ELASTICALLY RESTRAINED END AND A FREE END

Gary Anderson Feb. 1970 27 p refs

(AD-701893; WVT-7011) Avail: CFSTI CSCL 20/11

An analytical evaluation of an experimental procedure involving the free flexural vibrations of a clamped beam of circular cross section has been carried out. This work was undertaken in order to explain why certain experimental results seem to indicate that Youngs modulus E decreases as the length to diameter ratio of the beam decreases. Under the assumption that E remains constant, the analysis indicates that the boundary condition of vanishing slope at the clamped end is not realized in the laboratory. Using a modified boundary condition and a perturbation technique, a corrected relationship for E is obtained. Author (TAB)

N70-34186*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space System Div.

BIAXIAL STRENGTH OF MIG-WELDED AND TIG-WELDED 2014 T6 AT 70 DEG, -320 DEG AND -423F

R. A. Rawe 24 May 1968 68 p refs

(Contract NAS7-101)

(NASA-CR-109904; DAC-62102) Avail: CFSTI CSCL 20K

A test program was conducted to develop biaxial strength allowables for MIG and TIG welds in 2014-T6 aluminum. Welded cylinders, 16-in. in diameter and 60-in. long, were fabricated using procedures simulating actual production methods used for Saturn S-14B domes and common bulkheads. Certain of the specimens were subjected to a thermal curing cycle. The cylinders, each having two diametrically opposite longitudinal welds, were tested to failure at 70 deg, -310 deg and -423 F by combined internal pressurization and applied axial loading producing biaxial stress states of either 2-to-1 (axial-to-hoop) or 1-to-1 (axial-to-hoop). Under all test conditions the TIG-welded specimens exhibited greater biaxial strength than the MIG-welded specimens. Author

N70-34188*# Boeing Co., Washington, D.C.

STATISTICAL TRENDS ANALYSIS OF VIBRATION INDUCED SPACECRAFT FAILURES

Allen Y. Edelberg 16 Dec. 1968 71 p refs

(Contract NASw-1650)

NASA-CR-109903; D2-117083-1) Avail: CFSTI CSCL 20K

The results of a survey on spacecraft vibration induced failures experienced during laboratory testing and the launch and boost position of the mission are presented. Twenty-eight different types of spacecraft, involving 83 flight models, comprised the data sample. A statistical and reliability analysis, coupled with the failure data, was made to define the spacecraft vibration flight and test failure rate according to the complexity of the spacecraft, the severity of the vibration environment, and the intensity of the qualification and acceptance vibration test programs. Author

N70-34192# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF DEFORMATIONS BY THE THERMOELECTRIC METHODS

V. Ya. Bash et al Mar. 1970 21 p refs Transl. into ENGLISH from Prikladnaya Mekhan. (USSR), v. 5, 1969 p 117–124

(AD-705765; FTD-MT-24-15-70) Avail: CFSTI CSCL 20/11

Discussion of a thermoelectric method, developed under the assumption that the temperature of a body varies in proportion to the applied force, for studying elastic and elastoplastic strains in materials subjected to various types of loading. The method is applied to the determination of the temperature variations of a metallic rod under dynamic loading. The correctness of the basic assumption of the method is verified by tensile tests. It is shown that the magnitude of the temperature in the elastic region during tension depends both on the geometrical dimensions of the sample and on the strain rate. Using the method proposed, it is possible to determine the limit of proportionality of the temperature to the applied force. TAB

N70-34223# Royal Aircraft Establishment, Farnborough (England).

ON THE CALCULATION OF FATIGUE STRENGTH AT A STRESS CONCENTRATION [UEBER DIE BERUECKSICHTIGUNG DER SPANNUNGSKONZENTRATION BEI FESTIGKEITSBERECHNUNGEN]

H. Neuber Oct. 1969 25 p refs Transl. into ENGLISH from Konstruktion 20, no. 7, 1968 p 245–251

(RAE-LIB-Trans-1360) Avail: CFSTI

In calculations of the fatigue strength at stress concentrations the following two effects are to be considered. The micro-support effect related to the material structure, and the macro-support effect caused by the deviations from the linear stress-strain law. The micro-support effect can be calculated by means of the theory of mean stress value and the macro-support effect by non-linear shear theory. On the basis of these two theories a method of calculation is derived which is in good agreement with experimental results. Author

N70-34265# Politecnico di Torino (Italy). Ist. di Tecnologie Meccanica.

CUTTING FORCES IN THE INTERNAL GRINDING MACHINE [LE FORZE DI TAGLIO NELLA RETTIFICATURA PER INTERNI]

R. Ippolito 1968 18 p refs In ITALIAN Presented at 1st Natl. Conf. on Machine Tools, Milan, 10-12 Oct. 1968

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The changes in forces that occur during cutting, in material removal, is analyzed to gain practical data for industrial applications. The effects of velocity and cutting fluids are discussed. It is concluded that one of the principal problems in grinding is the structural alteration at the point of cutting due to the weight and high temperature. Transl. by F.O.S.

N70-34266# Politecnio di Torino (Italy). Ist. di Tecnologie Meccanica.

DIMENSIONAL AND FORCE ANALYSIS OF CUTTING IN FRONTAL COUNTERSINKING [ANALISI DIMENSIONALE E FORZE DI TAGLIO NELLA FRESATURA FRONTALE]

A. De Filippi 1968 28 p refs In ITALIAN Presented at 1st Natl. Conv. Machine Tools, Milan, 10-12 Oct. 1968

Avail: CFSTI

Dimensional analysis is presented as a method for studying the formation of chips in metal cutting. The method is applied to

the cutting forces at the point of contact. It is shown that these forces depend on the mechanical properties of the material, velocity, angle and depth of bite. Formulas are developed and experimentally verified. Transl. by F.O.S.

N70-34267# Politecnico di Torino (Italy). Ist di Costruzioni Aeronautiche.
THIN ELASTIC WALLS WITH DEVELOPABLE SURFACE AVERAGES. STATUS OF STRESS EMANATING FROM A GENERATOR [LA PARETE SOTTILE ELASTICA CON SUPERFICE MEDIA SVILUPPABILE. STATI DI TENSIONE MANANTI DA UNA GENERATRICE]
Giuseppe Surace 1969 17 p refs In ITALIAN *Its* No. 24
Avail: CFSTI

The theory of second approximation is used to analyze elastic thin walls with developable surface averages in which the force configurations hide a geometric discontinuity, or a long load generator expressed in first approximations for the Schorer cylinder and the Madwadski cone. It is concluded that it is possible to determine the tension and deformation in a panel subjected to forces distributed along a stress generator. Transl. by F.O.S.

N70-34268# Politecnio di Torino (Italy). Istituto di Costruzioni Aeronautiche.
THIN ELASTIC FLUTED WALLS. THE STATUS OF STRESSES RISING FROM AN ASYMPTOTIC LINE [LA PARETE SOTTILE ELASTICA RIGATA. STATI DI TENSIONE INSORGENTI DA UNA LINEA ASINTOTICA]
Giuseppe Surace 1969 16 p refs In ITALIAN *Its* No. 19
Avail: CFSTI

The states of tension and deformation that arise in a geometric discontinuity, or with loads along an asymptotic line in a corrugated surface are examined. A solution using sinusoidal laws along the plate boundary for a hyperbolic paraboloid is found which determines the tension. Transl. by F.O.S.

N70-34362*# Translation Consultants, Ltd., Arlington, Va.
FORCED VIBRATIONS OF LAMINATED ORTHOTROPIC CYLINDRICAL SHELLS [VYNUZHDENNYYE KOLEBANIYA SLOISTO-ORTOTROPNOY TSILINDRICHESKOY OBLOCHKI]
V. V. Yemelvanenko et al Washington NASA May 1970 8 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 4, 1969 p 116–120
(Contract NASw-2038)
(NASA-TT-F-12961) Avail: CFSTI CSCL 20K

A hypothetical mathematical study is made of forced oscillations of a three-layer laminated orthotropic cylindrical shell made of vitreous plastic. Specific shell and layer characteristics are given as well as the assumptions and hypotheses used in the theory. Both partial and complete solutions for general and derived equations are solved. The eigenfrequencies are determined for each different structure of the layers. The motion equation for an axisymmetrical problem is discussed for a shell under rapidly increasing internal pressure. The dynamic coefficient of deflection, w, when the pressure within the shell increases in one second from 0 to the magnitude 981.10000 n/sq m, is computed as an example. Author

N70-34505# Idaho Nuclear Corp., Idaho Falls.
ACOUST-S: A DIGITAL PROGRAM FOR ACOUSTIC TRIANGULATION OF SPHERICAL VESSELS
E. V. Waits Mar. 1970 22 p refs
(Contract AT(10-1)-1230)
(IN-1369) Avail: CFSTI

ACOUST-S was written as an extension of the original triangulation program ACOUST (IDO-17280) for the purpose of locating structural flaws on spherical pressure vessels. The program operates on time-of-arrival differences between unique acoustic transducers to locate points of structural flaw on spherical vessels. Flaw location is achieved by hyperbolic triangulation techniques. The program is designed to permit the location of sensors on inlet-outlet piping connected to the test vessel. Any portion of a spherical shape may be tested for acoustic emission points. ACOUST-S is written in FORTRAN 4 for use on the IBM 360 computer. The program requires 32,632 bytes of storage for execution. Standard input/output assignments are used in the program. An average triangulation problem will require about 0.04 minute execution time on the IBM 360/75 computer when using the FORTRAN 4 H level 2 compiler. Author (NSA)

N70-34510*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FRACTURE MECHANICS ANALYSIS OF APOLLO BLOCK 1 TITANIUM ALLOY PRESSURE VESSELS (COMMAND AND SERVICE MODULES)
S. V. Glorioso and G. M. Ecord Feb. 1967 50 p refs Program Apollo Working Paper No. 1325
(NASA-TM-X-64391) Avail: CFSTI CSCL 20K

A fracture mechanics analysis of the titanium alloy pressure vessels on the block I Apollo command and service modules is presented. The proof pressure test is the base line for the evaluation of the pressure vessels with respect to maximum flaw size possible after proof testing. A subsequent linear elastic fracture mechanics analysis of the maximum possible flaws with respect to subcritical growth is made for the various Apollo pressure vessel environments. The results show that in some cases, the maximum operating pressure of the vessels could cause flaw growth if the maximum flaw which would allow a successful proof test existed in the tank. The vessel design is controlled by the creep properties of the material at room temperature and consequently at the operating stress at cryogenic temperature the vessel is considered to be safe. The rationale used in the analysis of the pressure vessels and related experimental data are included. Author

N70-34534*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AN INVESTIGATION OF APOLLO TITANIUM PRESSURE VESSEL WELDS MADE WITH COMMERCIALLY PURE FILLER WIRE
Glenn M. Ecord Jan. 1968 40 p Program Apollo Working Paper No. 1333
(NASA-TM-X-64390) Avail: CFSTI CSCL 20K

A metallurgical investigation was undertaken to determine whether Apollo welds made with commercially pure wire exhibit hydrides and to determine the conditions under which titanium hydrides would form and precipitate a structural problem. The occurrence of hydride banding or agglomeration was not observed in Apollo production welds or in welds repaired by any of the methods in use. Attempts to produce the hydride banding in the Apollo commercially pure wire welds were successful only when hydrogen was charged into the material from an external source. The investigation has shown that the occurrence of hydride banding is not an inherent or inevitable condition when 6Al-4V titanium alloy is welded with unalloyed titanium filler metal. It is concluded that a titanium hydride problem does not exist for Apollo titanium 6Al-4V pressure vessels welded with commercially pure wire. Author

N70-34541*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
EVALUATION OF MIG AND TIG WELDING PROCESSES FOR JOINING 2014-T6 ALUMINUM ALLOY, PHASE 2
R. J. Davis [1969] 29 p refs
(Contract NAS7-101)
(NASA-CR-109897; DAC-62130) Avail: CFSTI CSCL 20K

This test was conducted to evaluate MIG and TIG welds for joining .250 inch thick, 2014-T6 aluminum alloy and to determine

the optimim cleaning procedures prior to TIG welding .100 inch thick 2014-T6. MIG and TIG welded test panels were evaluated on the basis of transverse weld and all-weld-metal tensile tests conducted at room temperature and at -423 F. The cleaning procedures prior to TIG welding were evaluated by the number of defects observed by X-ray and dye penetrant inspection after welding. The highest tensile strength was obtained with a 2-pass TIG weld on a stainless steel back-up bar. The optimum procedure for edge preparation prior to TIG welding was: deburr, scrape top and bottom surfaces, draw file, and prepare .030 inch radius on back edge. Author

N70-34579 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATION OF THE TORSIONAL OSCILLATIONS OF TURBINE ROTORS AND GENERATORS IN THE PRESENCE OF SUDDEN SHORT CIRCUITS [RASCHET KRUTILNYKH KOLEBANII ROTOROV TURBINY I GENERATORA PRI VNEZAPNOM KOROTKOM ZAMYKANII]
V. I. Berlyand et al Apr. 1970 17 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), no. 6, 1969 p 14–18
(NLL-RTS-5585) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d or 2 NLL photocopy coupons

Equations are derived to calculate the angles of twist and the elastic moments at the various sections of the driving shaft corresponding to these angles, which are due to the torsional oscillations caused by a short circuit in the generator. The problem is investigated for the linear case, although an approximative method is given for the cases where nonlinear elements are incorporated. An analysis of the results shows: (1) The maximal values of the elastic moments in shafts subjected to torsion can be set up both by two-phase and three-phase short circuits in the generator. (2) The maximal values of the elastic moments in all sections of the driving shaft are usually attained within the interval of from 0.06 to 0.10 seconds. (3) The calculated maximum stresses in the journals of the shafts of many turbines are very near to the elastic limits of the material under torsion. It is conjectured that the magnitudes of the stresses induced in the rotating shaft as the result of the elastic moments, determined by the method described, are somewhat over estimated. M.G.J.

N70-34632# Politecnico di Torino (Italy). Ist di Costruzioni Aeronautiche.
ON CALCULATIONS FOR CONTAINERS FOR NUCLEAR PLANTS. PART 1: THE GENERAL PROBLEM [SUL CALCOLO DEI CONTENITORI PER IMPIANTI NUCLEARI. PARTE 1: IL PROBLEMA GENERALE]
Giuseppe Surace [1970] 22 p refs In ITALIAN
Avail: CFSTI

Three possible cases of differential systems for couplings in expansion joints are written in second approximation for axisymmetrical situations subjected to pressure, axial loads, and thermal transients. After showing that the three system are reduced to a system of four differential equations, a matrix formulation is found for the resolution, by finite difference, which permits the determination of the characteristics and the internal displacement. Transl. by F.O.S.

N70-34633# Politecnico di Torino (Italy). Ist di Costruzioni Aeronautiche.
ON CALCULATIONS FOR CONTAINERS FOR NUCLEAR PLANTS. PART 2: THE EFFECTS OF PRESSURE AND AXIAL LOADS [SUL CALCOLO DEI CONTENITORI PER IMPIANTI NUCLEARI. PARTE 2: L'EFFETTO DELLA PRESSIONE E DEL CARICO ASSIALE]
Giuseppe Surace [1970] 51 p refs In ITALIAN
Avail: CFSTI

The calculation of the matrix of deformation of a toroidal connection with constant meridinal curvature is studied in ellipsoidal connections without the effects of pressure on the radial displacement and rotation of their edges. The internal coefficients are also determined. The effects of axial loading on shells, and formulations concerning toroidal shells are presented. Transl. by F.O.S.

N70-34634# Politecnico di Torino (Italy). Ist di Costruzioni Aeronautiche.
ON CALCULATIONS FOR CONTAINERS FOR NUCLEAR PLANTS. PART 3: THE THERMAL TRANSIENTS [SUL CALCOLO DEI CONTENITORI PER IMPIANTI NUCLEARI. PARTE 3: IL TRANSITORIO TERMICO]
Giuseppe Surace [1970] 20 p refs In ITALIAN
Avail: CFSTI

Formulations relative to stress causes in shells are developed for a joint of great curvature with axisymmetric thermal stress which is variable with time. Formulas are also derived for conditions due to external forces, and for the generations of heat within the layers of the wall. It is concluded that temperature variations amplify the stresses and deformations of shells. Transl. by F.O.S.

N70-34726 National Lending Library for Science and Technology, Boston Spa (England).
THERMAL STRESS IN A THIN OPEN SPHERICAL SHELL [NAPREZENIA TERMICZNE W CIENKIEJ OTWARTEJ POWLOCE KULISTEJ]
Z. F. Baczynski Aug. 1970 18 p refs Transl. into ENGLISH from Arch. Budowy Maszyn (USSR), v. 13, no. 3, 1966 p 365–376
(NLL-RTS-5908) Avail: Natl. Lending Library, Boston Spa, Engl: 34s or 6 NLL photocopy coupons

The solution of a boundary value problem of the theory of thermal stress for a thin open spherical shell of constant thickness is dealt with. An arbitrary axially symmetrical temperature field is considered; the temperature at the boundary (which constitutes a circularly conical surface) being zero. The state of stress and displacement is expressed in the general case of the temperature distribution in the form of series of ordinary and adjoint Legendre polynomials with real indices. In some cases of spherical shells and of heating, results can be obtained in closed form. Simple formulae and a numerical example are given. Author

N70-34764# National Lending Library for Science and Technology, Boston Spa (England).
THE STRESSED STATE OF A PLATE WEAKENED BY A BROKEN-LINE CRACK [NAPRYAZHENNOE SOSTOYANIE PLOSKOSTI, OSLABLENNOY LOMANOY TRESHCHINOY]
V. I. Mossakovskiy et al Apr. 1970 9 p refs Transl. into ENGLISH from Kontsentratsiya Napryazheniy (USSR), v. 1, 1965 p 188–192
(NLL-RTS-5664) Avail: Natl. Lending Library, Boston Spa, Engl: 12s 6d or 2 NLL photocopy coupons

An infinite plate weakened by a crack loaded in tension by forces which are not perpendicular to the center line of the crack, in which the crack develops at an angle to the initial direction, is considered. To solve the problem of crack development it is necessary to know the stress distribution in a plate weakened by a broken-line crack, i.e. a crack which changes direction at inflection points. Formulas are derived and boundary conditions established for stress components of complex variables as well as the stress on the edge of the crack, which completely solve the problem. E.M.C.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-33403# Israel Program for Scientific Translations, Ltd., Jerusalem.
THERMOPHYSICAL PROPERTIES OF LIQUID AIR AND ITS COMPONENTS
A. A. Vasserman et al 1970 312 p refs Transl. into ENGLISH of the book "Teplofizicheskie Svoistva Zhidkogo Vozdukha i Ego Komponentov" Moscow, Izd. Komitetastandartov, 1968 Prepared by Dept. of Comm. and NSF
(TT-69-55092) Copyright. Avail: CFSTI

The thermophysical properties of liquid nitrogen, oxygen, argon, and air are examined. Equations of state are derived for liquids on the basis of the principles of statistical physics, and are valid for many temperatures and densities. A method is developed for setting up these equations; it is used to describe analytically the thermal properties of the four most important cryogenic liquids. The experimental thermal data for the liquefied gases are extrapolated to pressures of 500 bar. Equations of state valid for pressures of practical importance are established and the thermal and caloric properties of these substances are calculated for parameters which are not studied experimentally. The values obtained for the density are used in tabulating the viscosity and conductivity of the four liquids with the aid of the limited experimental material on transfer of coefficients. Author

N70-33404# Israel Program for Scientific Translations, Ltd., Jerusalem.
THERMOPHYSICAL PROPERTIES OF GASES AND LIQUIDS
V. A. Rabinovich, ed. 1970 215 p refs Transl. into ENGLISH of the book "Teplofizicheskie Kharakteristiki Veshchestv" Moscow, Izd. Komiteta Standartov, 1968 Prepared for Dept. of Commerce and NSF
(TT-69-55091) Copyright. Avail: CFSTI

A collection of papers dealing with the theoretical calculation and experimental determination of the thermophysical characteristics of substances and materials is presented. It also contains papers devoted to methods of calculation and derivation of equations of state for pure substances and gas mixtures. Author

N70-33442# Boeing Scientific Research Labs., Seattle, Wash.
JOULE HEATING OF A PLATE ELECTRODE IN A FREE ARC DISCHARGE
F. Edward Ehlers and Donald F. Winter Dec. 1969 31 p refs *Its* Mathematical Note 636
(AD-705645; D1-82-0942) Avail: CFSTI CSCL 20/13

To estimate the heating of an airplane wing from a lightning stroke, the Joule heating in an infinite plate was analyzed. From experiments with argon arcs, it has been observed that the surface current density from an arc in which the plate acts as anode is approximated closely by a Gaussian distribution. With this boundary condition on one surface, the quasi-steady current distribution inside the plate was found from a solution of Maxwells equations. By the use of a simple approximation of the interior current density distribution for plates which are thin compared with the arc radius as the source term in the heat equation, the solution to the temperature enhancement in the plate was found by means of the Bessel and Laplace transforms. A solution for thick plates also was obtained by using an approximation to the current in the plate in the neighborhood of the arc axis where most of the heating occurs. Author (TAB)

N70-33479# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
A FURNACE FOR TESTING NEUTRON SPECTROMETRY ON MONOCRYSTALS [FORNO PER ESPERIENZE DI SPETTROMETRIA NEUTRONICA SU MONOCRISTALLI]
L. Esposito, G. Rizzi, and G. Cubiotti 6 Oct. 1969 7 p ref In ITALIAN
(RT/MET(69)4) Avail: CFSTI

A furnace with a temperature range up to 700 C for neutron spectrometry on monocrystals is described. The sample can be kept in an inert gas atmosphere or in a vacuum. In equilibrium condition the temperature stability is within 2 C with a difference of 1 C between the lower and the upper limit of the sample. Author

N70-33489# Middle East Technical Univ., Ankara (Turkey). Faculty of Engineering.
EFFECTS OF BOUNDARY CONDITIONS ON FORCED CONVECTION HEAT TRANSFER
Sadik Kakac (Ph.D. Thesis 1966) 1968 115 p refs Sponsored by UNESCO
(Publ-19) Avail: CFSTI

The fundamental equations which govern the flow of fluids and heat transfer are discussed. The effects of constant wall temperature and heat flux boundary conditions are studied by digital computer for forced-convection heat transfer in turbulent flow through a duct. Beginning from the transient energy equation, it is shown that heat flux which varies exponentially in time and along the duct gives a uniform heat transfer coefficient. Laminar flow heat transfer is considered by using integral and numerical methods for flow through a duct with parallel sides. Author

N70-33519# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
THE INFLUENCE OF SURFACE MELTING OR SURFACE VAPORIZATION ON THE TEMPERATURE DISTRIBUTION IN A PLATE
F. Edward Ehlers Jan. 1970 23 p refs *Its* Mathematical Note 637
(AD-705640) Avail: CFSTI CSCL 20/13

During a lightning stroke on the wing of an airplane, the surface may become heated until melting or vaporization of the metal occurs. To gain some insight into the significance of this melting or vaporization on the temperature of the inner surface of the wing near the fuel, an approximate solution was obtained for the temperature in a plate when one surface is heated uniformly at a constant rate sufficiently long that melting occurs. It was assumed that the melted material is removed as soon as it reaches the melting temperature. The resulting equation of the conservation of heat flux at the melting surface, which includes the absorption of energy from the latent heat of melting, and the heat equation with appropriate moving boundary conditions yields a coupled system of differential equations to be solved for the amount of melt and for the temperature in the plate. An iteration procedure was developed and the first approximation obtained. Author (TAB)

N70-33812# Dartmouth Coll., Hanover, N. H., Thayer School of Engineering.
CONDENSATION OF STEAM IN A CONSTANT AREA DUCT
Andrej Aplenc and Graham B. Wallis Nov. 1969 73 p refs
(Grant NSF GK-1841)
(PB-189685) Avail: CFSTI CSCL 20D

An attempt is made to describe the condensation of steam in a vertical pipe of constant cross-section by a one-dimensional mathematical model, using the Reynolds flux concept. Superheated steam and compressibility effects are included. Author (USGRDR)

N70-33929# General Applied Science Labs., Inc., Westbury, N.Y.
PILOT GAS GENERATOR IGNITION OF LIQUID STORABLE FUELS IN A HIGH SPEED AIRSTREAM Final Report
Raymond B. Edelman, Stephen Schmotoloche, and Simon Slutsky Apr. 1970 67 p refs
(Contract F44620-69-C-0056)
(AD-705649; GASL-TR-740; AFOSR-70-1207TR) Avail: CFSTI CSCL 21/2

A study was performed to determine some of the combustion and flow characteristics associated with piloted ignition of liquid hydrocarbons injected directly into a supersonic air stream.

Experiments were performed in a direct connect constant area combustor supplied by a Mach 2 air stream at a static pressure level of 1 atmosphere and at total temperatures ranging from ambient (530 R) to approximately 3300 R. The fuel was liquid hexane and was injected laterally into the flow through piloted and non-piloted injector configurations. Measurements include penetrations, combustor wall static pressure distributions and property profiles at two axial stations downstream of the injection point. It was found that autoignition and stable combustion occurs for total temperatures above about 2600 R. For temperatures below this limit minimum piloting requirements were established and it was found that the pilot mass flows needed for sustained combustion were small compared to the main fuel and air flow rates. Comparison with available theory indicates combustion efficiencies greater than 90% were obtained. Author (TAB)

N70-33958*# Stanford Univ., Calif. Thermosciences Div.
THE TURBULENT BOUNDARY LAYER ON A POROUS PLATE: EXPERIMENTAL HEAT TRANSFER WITH UNIFORM BLOWING AND SUCTION, WITH MODERATELY STRONG ACCELERATION
W. H. Thielbahr, W. M. Kays, and R. J. Moffat Apr. 1970 37 p refs
(Grants NGL-05-020-134; NSF GK-2201)
(NASA-CR-109866; SU-HMT-11) Avail: CFSTI CSCL 20D

Experimental data are presented for heat transfer to the transpired turbulent boundary layer subject to acceleration at constant values of the acceleration parameter, K, of approximately 0.00000145. This is a moderately strong acceleration, but not so strong as to result in laminarization of the boundary layer. The results for transpiration fractions, F, of -0.002, 0.0, and +0.0058 are presented in detail in tabular form, and in graphs of Stanton number versus enthalpy thickness Reynolds number. In addition, temperature profiles at several stations are presented. Stanton number results for F = -0.004, +0.002, and +0.004 are also presented, but in graphical form only. The data were obtained using air as a working fluid, at relatively low velocities, and with temperature differences sufficiently low so that the influence of temperature-dependent fluid properties is minimal. All data were obtained with the surface maintained at a temperature invariant in the direction of flow. Author

N70-33959*# Louisiana State Univ., Baton Rouge. Reacting Fluids Lab.
FORMULATION, DERIVATION AND DEVELOPMENT OF THE ANALYSIS OF THE INTERACTION OF ABLATING PROTECTION SYSTEMS AND STAGNATION REGION HEATING
C. D. Engel, D. D. Esch, R. C. Farmer, and R. W. Pike 1 Jan. 1970 117 p refs
(Grant NGR-19-001-059
(NASA-CR-66931; NASA-RFL-TR-70-1) Avail: CFSTI CSCL 20M

The conservation equations for a multicomponent, radiating, chemically reacting fluid in local thermodynamic equilibrium are derived. From the conservation equations the thin shock layer equations are developed. These equations appropriately describe the flow in a shock layer produced by a blunt body during a hyperbolic entry, atmospheric encounter. Special attention is given to radiation, chemical reaction and mass transport fluxes. Stagnation line equations are derived from the shock layer equations by taking appropriate limits and are discussed from a mathematical view point as initial conditions for the shock layer equations. Boundary conditions for these equations are derived and discussed in the light of ablator response coupling with the flow-field. Author

N70-33967# Houston Univ., Tex. Dept. of Mechanical Engineering.
THE VAPOR EXPLOSION: HEAT TRANSFER AND FRAGMENTATION. VOLUME 2: TRANSITION BOILING FROM SPHERES TO WATER
J. W. Stevens, R. L. Bullock, L. C. White, and J. E. Cox Apr. 1970 22 p refs
(Contract AT(40-1)-3936)
(ORO-3936-3-Vol-2) Avail: CFSTI

Experimental work concerning transition boiling during free and forced convection from spheres was described. This study is included under an overall program to investigate the heat transfer and fragmentation mechanisms involved with explosive vapor formation caused by dispersion of molten materials in water. The nature of transition for both free and forced convection boiling around small spheres in water was established. Heat transfer rates were calculated from experimental temperature-time measurements and compared with rates obtained under steady-state conduction. Author (NSA)

N70-34045*# Translation Consultant, Ltd., Arlington, Va.
A STATISTICAL METHOD FOR OBTAINING THE COMBUSTION CHARACTERISTICS OF METAL PARTICLES [STATISTICHESKIY METOD POLUCHENIYA KHARAKTERISTIK GORENIYA CHASTITS METALLOV]
M. A. Gurevich et al Washington NASA Aug. 1970 8 p ref Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), v. 5, Sep. 1969 p 441-444
(Contract NASw-2038)
(NASA-TT-F-13164) Avail: CFSTI CSCL 21B

A description is given of a method which makes it possible to relate the size of a particle to the combustion time of the particle on the basis of experiments using a broad powder fraction. According to the proposed method, the particle size distribution and the distribution of the particles with respect to characteristic time are determined for the test fraction, and a comparison of the distribution laws makes it possible to establish a relation between the size and the time. The results of a verification of the method on a polydisperse magnesium powder consisting of spherical particles are cited, showing an induction time proportional to the square of the particle size and a combustion time proportional to the third power of the particle size. Author

N70-34058# Kentucky Univ., Lexington. Dept. of Engineering Mechanics.
THERMAL EFFECTS IN SOLIDS Final Technical Report 1 Nov. 1965-31 Oct. 1969
O. W. Dillon 31 Oct. 1969 11 p refs
(Contract AF 49(638)-1646)
(AD-701777; AFOSR-70-0479TR) Avail: CFSTI CSCL 20/11

The research has been done in a combined theoretical and experimental program and contains contributions in two main areas: The thermodynamic basis of plasticity; and Plastic deformation waves. Author (TAB)

N70-34216*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROLE OF THE SURFACE IN THE MEASUREMENT OF THE LEIDENFROST TEMPERATURE
Kenneth J. Baumeister, Robert E. Henry (Argonne Natl. Lab., Ill.), and Frederick F. Simon 1970 17 p refs Proposed for presentation at the Spec. Session on Augmentation of Convective Heat and Mass Transfer of the Am. Soc. of Mech. Engr. Winter Ann. Meeting, New York, 29 Nov.-3 Dec. 1970
(NASA-TM-X-52866; E-5828) Avail: CFSTI CSCL 20M

Aluminum, brass, stainless steel, gold plated copper, and pyrex glass surfaces were used to investigate the effect of surface properties on the Leidenfrost temperature. The initial drop radius, heater surface characteristics, and liquid subcooling were related by a conduction model to the Leidenfrost point. The model indicates the important parameters affecting the Leidenfrost point. Using this model, most of the variation of Leindenfrost temperature reported in the literature could be delineated. Also, for practical purposes

experimental evidence indicates a possible equivalence between the Leidenfrost and the minimum temperature in a pool boiling system. Surface roughness and contamination, particularly for water, are shown to have extremely large effects on the Leidenfrost and minimum temperatures. Author

N70-34245*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF ROUGHNESS ON HEAT TRANSFER IN CONICAL NOZZLES
Meyer Reshotko, Donald R. Boldman, and Robert C. Ehlers [1970] 12 p refs To be presented at the Spec. Session on Augmentation of Convective Heat and Mass Transfer of the Am. Soc. of Mech. Engr. Winter Ann. Meeting, New York, 29 Nov.–3 Dec. 1970
(NASA-TM-X-52864) Avail: CFSTI CSCL 20M

A study is presented on the effects of various degrees of surface roughness on heat transfer in two conical converging diverging nozzles with different convergence angles using heated air. Roughness levels up to 325 rms were considered. Roughness causes detransition from turbulent flow to take place at a lower Reynolds number than that for a smooth wall. In the turbulent regime the heat transfer is not noticeably affected until the roughness height is greater than a given height which seems to correspond to the approximated sublayer height. Author

N70-34246# Naval Postgraduate School, Monterey, Calif.
THE OPERATION OF A ROTATING, WICKLESS HEAT PIPE
Leonard John Ballback (M.S. Thesis) Dec. 1969 53 p refs
(AD-701674) Avail: CFSTI CSCL 13/1

A Nusselt type analysis was performed during laminar film condensation on the inside of a rotating truncated cone. This analysis was employed to determine the condensing limit of a wickless heat pipe, rotating about its longitudinal axis. Performance characteristics including the effects of geometry, rotational speed, and the characteristics of fluid are given. A comparison is made between the condensing, boiling, sonic, and entrainment limits for a given heat pipe geometry. Author (TAB)

N70-34254*# Naval Postgraduate School, Monterey, Calif.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF ROTATING, NON-CAPILLARY HEAT PIPES . Annual Report, Sep. 1969–Jun. 1970
P. J. Marto, T. J. Daley, and L. J. Ballback 30 Jun. 1970 42 p refs
(NASA Order W-13007)
(NASA-CR-109894; NPS-59MX70061A) Avail: CFSTI CSCL 20M

An analytical review of the operation of rotating, non-capillary heat pipes is presented, including a discussion of film condensation on the inside of a rotating, truncated cone. Predicted results so far obtained indicate that the heat transfer capability of rotating, non-capillary heat pipes depends upon condenser performance and is substantially higher than the capability of conventional, wick-limited heat pipes. The design and manufacture of an experimental rotating heat pipe apparatus is also described. Author

N70-34261*# Techtran Corp., Glen Burnie, Md.
GENERALIZATION OF GRADIENT METHOD OF HEAT TRANSFER INVESTIGATIONS FOR THE CASE OF ARBITRARY DEPENDENCE OF THE THERMAL CONDUCTIVITY COEFFICIENT OF THE WALL ON TEMPERATURE [OBOBSHCHENIYE GRADIYENTNOGO METODA ISSLEPOVANIYA TEPLOOTDACHI NA SLUCHAY PROIZVOLNOY ZAVISIMOSTI KOEFFITSIYENTA TEPLOPROVODNOSTI MATERIALA STENKI OT TEMPERATURY]
V. K. Shcukin et al Washington NASA May 1970 9 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), no. 1, 1969 p 105–109
(Contract NASw-2037)
(NASA-TT-F-12983) Avail: CFSTI CSCL 20M

The thermal fluxes on the inner surface of a tube, determined by the temperature distribution on its surfaces on the basis of a unidimensional temperature field, is compared for the purpose of evaluating the possible magnitude of error involved in the generalized gradient method using the analytical solution of Dirichlet's problem of the temperature field in a wall that transfers heat. Author

N70-34313*# Techtran Corp., Glen Burnie, Md.
CONJUGATE PROBLEM OF HEAT EXCHANGE WITH RADIANT HEAT EXCHANGE NEAR PLATE SURFACE [SOPRYAZHENNAYA ZADACHA O TEPLOOGMENE PRI NALICHII LUCHISTOGO TEPLOOGMENA U POVERKHNOSTI PLASTINY]
L. I. Kudryashev et al Washington NASA 13 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), no. 1, 1969 p 77–84
(Contract NASw-2037)
(NASA-TT-F-12981) Avail: CFSTI CSCL 20M

The conjugate problem of heat exchange with radiant heat exchange near the surface of a plate is broken down into two different problems. The first is heating of a plate that is adiabatic on one side during radiation from the opposite surface in an absolutely transparent gas. The second is the problem where heating of the surface of a plate occurs not only as the result of convective heat exchange, but also of radiant heat exchange with the radiation of the combustion products. Author

N70-34381# Politecnico di Torino (Italy). Ist. di Meccanica Applicata Aerodinamica e Gasdinamica.
TRANSIENT HEAT CONDUCTION WITH TIME DEPENDENT BOUNDARY CONDITIONS
Mario Laudanna and Fiorenzo Quori Dec. 1969 25 p refs
(Contract AF-EOAR-68-0049)
(AD-705188; AFOSR-70-1117TR; SR-6; TN-52) Avail: CFSTI CSCL 20/13

Transient heat conduction problems with time dependent boundary conditions or coupled heat transfer effects for a semi-infinite solid with a plane boundary surface are studied. Some examples are developed and the results are compared, when possible, with the exact or approximate solutions obtained by other authors. Author (TAB)

N70-34438*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
APPLICATION OF HEAT PIPES TO SPACECRAFT THERMAL CONTROL PROBLEMS
J. L. Thurman and S. Mei Jul. 1968 102 p refs
(Contract NASB-20073)
(NASA-CR-109991; TN-AST-275) Avail: CFSTI CSCL 20M

The applicability of heat pipes to the solution of thermal control problems associated with future spacecraft, including the Saturn V workshop is investigated. The investigation includes a survey of reported experience in heat pipe technology, an analysis of the effect of variation in various design parameters on heat pipe performance, and establishment of concepts utilizing the heat pipe which offer unique solutions to specific thermal control problems. Concepts are described and analyzed which appear applicable to the solution of problems of cryogenic boiloff control, temperature nonuniformity of skin structure, removal of heat from concentrated sources, and radiator design. Author

N70-34540* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTRIC-ARC HEATER Patent
Robert F. Mayo, Milton A. Wallio, and William L. Wells, inventors (to NASA) Issued 17 Aug. 1965 (Filed 12 Mar. 1963) 6 p Cl. 219-121
(NASA-Case-XLA-00330; Us-Patent-3,201,560;

US-Patent-Appl-SN-264729) Avail: US Patent Office CSCL 13A

A magnetically diffused radial electric arc heater for more uniform and efficiently heating the fluid medium is described. The heater also provides reduced energy loss, low electrode erosion rate, decreased fluid contamination, increased voltage drop across the arc and arc power capability, and stable arc operation. A pair of concentric, coaxially extending electrodes are connected by an electrical circuit. A field coil is positioned about the electrodes for creating an axial, high intensity magnetic field with a transverse component of 7.5 gauss per ampere of arc current. Stable arc operation is obtained with a series circuit containing power source, coil, electrodes, and arc. The magnetic field induces rotation of the arc and causes diffusion of the arc by reducing the mean free path length of the current carriers. The arc current and voltage characteristics are dependent upon the magnetic field conditions. N.E.N.

N70-34548* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH TEMPERATURE HEAT SOURCE Patent

Alex Vary, inventor (to NASA) Issued 15 Jun. 1965 (Filed 17 Jan. 1963) 3 p Cl. 219-347

(NASA-Case-XLE-00490; US-Patent-3,189,726; US-Patent-Appl-SN-252259) Avail: US Patent Office CSCL 13A

A high temperature helical source of thermal radiation which requires a low electrical current for operation, and has a very low resultant magnetic field is described for use in heating emitter electrodes. This device prevents the sagging of the heater elements at elevated temperatures, and reduces the adverse effects of thermal expansion. F.O.S.

N70-34607*# National Aeronautics and Space Administration. Manned Spaceflight Center, Houston, Tex.

THERMO-STRUCTURAL FAILURE LIMITS FOR THE SPACECRAFT COMPONENT FOR AN APOLLO 1B LAUNCH ENVIRONMENT

C. D. Faust (TRW Systems), A. Gillies (TRW Systems), and R. G. Posgay (TRW Systems) 25 Apr. 1967 37 p refs

(NASA-TM-X-64370; TRW-05952-H177-R0-00; MSC-67-FM-50) Avail: CFSTI CSCL 13M

This study is an analysis of the structural failure limits of the spacecraft components of the mission AS-204 launch configuration when the effects of aerodynamic heating on structural capability are considered. The study is limited to slow divergence dispersions that are detectable by ground based equipment. Structural loads were computed by the TRW N-stage computer program. Skin temperatures were computed using the TRW ascent heating program which was developed for use in this task. Author

N70-34736# California Univ., Livermore. Lawrence Radiation Lab.

EFFECT OF MAGNETIC FIELDS ON HEAT PIPES

Gustav A. Carlson and Myron A. Hoffman 31 Dec. 1969 30 p refs Presented at the ASME Space Technol. and Heat Transfer Conf., Los Angeles, 21-24 Jun. 1970

(VCRL-72060; Conf-700604-1) Avail: CFSTI

Heat pipes have been proposed for use in environments where there are strong magnetic fields such as in controlled fusion reactors. The presence of a magnetic field can influence the performance of a heat pipe significantly, depending on the heat pipe geometry, its orientation in the magnetic field, the heat pipe materials and fluid properties as well as the magnetic field strength. A liquid-metal heat pipe, specifically designed to operate in a magnetic field, will employ a compound wick structure with the optimum liquid flow passage size larger and the vapor flow passage proportionately smaller than for the no-magnetic-field design. The basic conclusion is that the presence of magnetic field always results in a lower maximum heat flux capability, but the detrimental effects of the magnetic field can be greatly reduced by using a heat pipe geometry optimized for operation in the specific magnetic field environment. Author (NSA)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-33501# Joint Publications Research Service, Washington, D.C.

SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 299

26 May 1970 62 p refs Transl. into ENGLISH from various Russian publications

(JPRS-50591) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1-6 refs (See N70-33502 18-30)
2. METEOROLOGY p 7-20 refs (See N70-33503 18-20)
3. OCEANOGRAPHY p 21-27 refs (See N70-33504 18-13)
4. TERRESTRIAL GEOPHYSICS p 28-38 refs (See N70-33505 18-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 39-62 refs (See N70-33506 18-13)

N70-33556# Joint Publications Research Service, Washington, D.C.

SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 227

30 Apr. 1970 96 p Transl. into ENGLISH from Russian reports (JPRS-50440) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1-8 (See N70-33557 18-30)
2. METEOROLOGY p 9-27 (See N70-33558 18-20)
3. OCEANOGRAPHY p 28-34 (See N70-33559 18-13)
4. TERRESTRIAL GEOPHYSICS p 35-45 (See N70-33560 18-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 46-67 (See N70-33561 18-29)

N70-33572# Joint Publications Research Service, Washington, D.C.

SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 226

14 Apr. 1970 74 p Transl. into ENGLISH from RUSSIAN reports (JPRS-50316) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1-13 (See N70-33573 18-30)
2. METEOROLOGY p 14-31 (See N70-33574 18-20)
3. OCEANOGRAPHY p 32-45 (See N70-33575 18-13)
4. TERRESTRIAL GEOPHYSICS p 46-51 (See N70-33576 18-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 52-65 (See N70-33577 18-29)

N70-33593# Naval Research Lab., Washington, D.C.

REPORT OF NRL PROGRESS, APRIL 1970

Apr. 1970 32 p refs

Avail: CFSTI CSCL 11/6

CONTENTS:

1. SPECIFIC HEAT AND ELECTRICAL RESISTIVITY OF EXCHANGE-ENHANCED DILUTE Pt-Ni ALLOYS C. A. Macklin, A. I. Schindler, and D. J. Gillespie p 1-9 refs (See N70-33594 18-17)
2. PROBLEM NOTES p 10-28 refs (See N70-33595 18-34)

N70-33595# Naval Research Lab., Washington, D.C.
PROBLEM NOTES
In its Rept. of NRL Progr. Apr. 1970 p 10-28 refs (See N70-33593 18-34)
Avail: CFSTI CSCL 20/12

Research progress is reported on calibration of X-ray ionization chambers used in Solrad and OGO satellites, an improved instrument ball bearing lubricant, digital communication, electronic components and instrumentation, number theory, micromechanical metallurgy and the metallic state, marine corrosion, reactor operations, nuclear background and measurement, strength of solids, high temperature plasma physics, IFF system for radar identification, and transient radiation effects on ruby lasers. R.B.

N70-33600# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS, MAY 1970
May 1970 52 p refs
Avail: CFSTI

CONTENTS:

1. A PROPORTIONAL COUNTER FOR THERMALLY STIMULATED EXOELECTRONS F. H. Attix p 1-14 refs (See N70-33601 18-14)

2. PROBLEM NOTES p 15-41 refs (See N70-33602 18-34)

3. SUPPORTING TECHNIQUES S. H. Hersh p 41-43 (See N70-33603 18-34)

N70-33602# Naval Research Lab., Washington, D.C.
PROBLEM NOTES
In its Rept. of NRL Progr. May 1970 p 15-41 refs (See N70-33600 18-34)
Avail: CFSTI

Progress summaries are presented on problems associated with the research and development program. Reported projects include: (1) scattering of underwater sound by the ocean's surface; (2) determination of the effect of the Apollo Telescope Mount launch and space environment on photographic films; (3) surface chemical aspects of reinforced plastics; (4) adhesive bond failures in aircraft honeycomb-sandwich composites; (5) switching inverter with sine-wave output; (6) microwave switching schemes and variable power division networks; (7) iterative technique for reducing sidelobes of circular and cylindrical arrays; (8) preparation of single crystal GaAs on insulating substrates; (9) oriented growth of spinel on sapphire; (10) temperature dependence of the irradiation-induced uniaxial anisotropy energy; (11) mechanisms of neutron radiation damage to structural metals; (12) radiative corrections to electron scattering from complex nuclei; (13) detection and characterization of surface-active material in the marine atmosphere; and (14) machine plotting of radio/radar vertical-plane coverage diagrams. D.L.G.

N70-33603# Naval Research Lab., Washington, D.C. Solid State Technology Branch.
SUPPORTING TECHNIQUES
S. H. Hersh *In its* Rept. of NRL Progr. May 1970 p 41-43 (See N70-33600 18-34)
Avail: CFSTI

The design and fabrication are reported for two low cost devices and include: (1) a stable thin-film thickness monitor; and (2) a high frequency water-cooled RF feed-thru. D.L.G.

N70-33618# Joint Publications Research Service, Washington, D.C.
INFORMATION SYSTEMS, USSR
11 Jun. 1970 27 p refs Transl. into ENGLISH from Nauchno-Tekhn. Inform. (Moscow), no. 1, 1970 1, p 3-6; 2, p 10-14
(JPRS-50718) Avail: CFSTI

CONTENTS:

1. MEANS OF IMPROVING THE EFFICIENCY OF INFORMATION AND CONTROL SYSTEMS B. I. Polikarpov 1-11 (See N70-33619 18-10)

2. SCIENTIFIC INFORMATION AND FORECASTING A. D. Ursul et al p 11-25 refs (See N70-33620 18-34)

N70-33620# Joint Publications Research Service, Washington, D.C.
SCIENTIFIC INFORMATION AND FORECASTING
A. D. Ursul et al *In its* Inform. Systems, USSR 11 Jun. 1970 p 11-25 refs
Avail: CFSTI

The statistical and nonstatistical methods of utilizing information theory for forecasting and for constructing a general information model for the forecasting process are investigated. The construction of this model is based on processing scientific and technical information. J.M.C.

N70-33651# National Research Council of Canada, Ottawa (Ontario).
THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT Quarterly Bulletin, 1 Oct.-31 Dec. 1969
31 Dec. 1969 106 p refs
(DM-/NAE-1969(4)) Avail: CFSTI

CONTENTS:

1. NEW DEVELOPMENTS IN THE FINITE ELEMENT ANALYSIS OF SHELLS G. M. Lindberg, M. D. Olson, and G. R. Cowper p 1-38 refs (See N70-33652 18-32)

2. PRODUCTION OF PRECISION FOAM PLASTIC PRODUCTS BY PRESSURE MOLDING OF FOAM SLABS IN A HOT MOLD D. A. Baker p 39-45 (See N70-33653 18-15)

3. NAE FLIGHT IMPACT SIMULATOR J. W. Noonan and J. B. R. Heath p 47-68 refs (See N70-33654 18-11)

4. CURRENT PROJECTS p 71-99 (See N70-33655 18-34)

N70-33655# National Research Council of Canada, Ottawa (Ontario).
CURRENT PROJECTS
In its The Div. of Mech. Eng. and The Natl. Aeron. Estab. 31 Dec. 1969 p 71-99 (See N70-33651 18-34)
Avail: CFSTI

The current studies and available facilities of Canadian laboratories are listed. F.Q.S.

N70-33661# Joint Publications Research Service, Washington, D.C.
SOVIET RESEARCH IN SANITATION AND NOISE MEASUREMENT
11 Jun. 1970 19 p refs Transl. into ENGLISH from Gig. Sanit. (Moscow), No. 4, 1970 p 98-103
(JPRS-50713) Avail: CFSTI

CONTENTS:

1. SANITIZING THE AIR IN THE GEORGIAN SSR O. P. Shalamberidze et al p 1-5

2. TREATMENT OF WATER WITH POTASSIUM PERMANGANATE TO REMOVE TASTES AND ODORS S. I. Dobrushina et al p 6-10 (See N70-33662 18-05)

3. COMPLETE LABORATORIES FOR THE MEASUREMENT OF VIBRATION AND NOISE O. Ye. Guzeyev et al p 11-13 (See N70-33663 18-11)

4. NOISE ON ZAKARPATSKAYA OBLAST MOTOR HIGHWAYS N. F. Grishchenko et al p 14-17

N70-33668*# National Aeronautics and Space Administration, Electronics Research Center, Cambridge, Mass.
A BIBLIOGRAPHICAL SURVEY OF LARGE-SCALE SYSTEMS

William R. Corliss 30 Jun. 1970 57 p refs
(NASA-TM-X-64293) Avail: CFSTI CSCL 09B

A limited, partly annotated bibliography was prepared on the subject of large-scale system control. The references are divided into thirteen application areas, such as large societal systems and large communication systems. Author

N70-33933*+ Syracuse Univ., N.Y. Coll. of Business Administration.
TECHNOLOGY IN RETROSPECT AND CRITICAL EVENTS IN SCIENCE: A SUMMARY AND CRITIQUE OF FINDINGS BY IIT
Peter G. Franck Dec. 1969 14 p *Its* Occasional Paper No. 3
(Grant NGL-33-022-090)
(NASA-CR-109887; Rept-6225-OP-3) Avail: CFSTI CSCL 05D

A summary is presented on the results of a study on the critical events leading up to an innovation. Three illustrations influencing the chemical and engineering industry are reviewed: magnetic ferrites, the video tape recorder, and the electron microscope. The critical events are identified as the distinct research milestones contributing to the innovation. The time histories from the first critical events to the innovation, the diverse contributing disciplines, the various contributing institutions, and the influence fo foreign research are discussed. The role of the time factor from research to innovation is emphasized, and it is felt that the time factor of ten to twenty years indicates the need for interchange between the industrial research and the academic communities. N.E.N.

N70-33934*# Syracuse Univ., N.Y.
INTERDISCIPLINARY RESEARCH IN THEORY AND PRACTICE: A VIEW FROM THE UNIVERSITY
William Edgar Davis, III (M.S. Thesis) Apr. 1970 157 p refs
(Grant NGL-33-022-090)
(NASA-CR-109888; Rept-6221-TD-1) Avail: CFSTI CSCL 05A

The interdisciplinary research supported by NASA's Sustaining University Program is investigated. A multidisciplinary research team is defined as a group with members from two or more disciplines, and an interdisciplinary group is as characterized by cooperative, coordinated, and sustained interaction between members of different disciplines. It is concluded that NASA's intention to encourage interdisciplinary research was in most cases not realized. The main difficulties are identified as the following: Many university people do not understand the foundation underlying such research and do not perceive the potential utility and value. Only some researchers consider its utility great enough to justify the risks and difficulties. Many university researchers and administrators are reluctant to encourage such research because they anticipate they cannot do so effectively. A lack of distinction between multidisciplinary and interdisciplinary research by both university and NASA personnel resulted in too much of the former. The agency's emphasis on 'multidisciplinary' research combined with the universities' undiscriminating scramble for funds resulted in confusion of means and ends. Few agency and university people really pursued the task with much conviction, initiative, and design. N.E.N.

N70-33962*# National Aeronautics and Space Administration, Washington, D.C.
TWENTY-FIRST SEMIANNUAL REPORT TO CONGRESS, 1 JANUARY - 30 JUNE 1969
G. B. De Gennaro, H. H. Milton, and W. E. Boardman, eds. 30 Jun. 1969 258 p
(NASA-TM-X-64292) Avail: SOD $1.25; CFSTI CSCL 05D

Activities of the 6-month period are reported on manned space flight, space science, satellite observations, advanced research and technology, NERVA program, tracking and data acquisition, international affairs, university programs, informational and educational programs, and supporting activities. Highlights of the period are identified as the Apollo 9 and 10 demonstrations of the lunar module ability; studies of the regions surrounding the earth, moon, and sun; orbiting of a biosatellite; operation of sophisticated weather satellites and advanced commercial communications spacecraft; and progress in avoinics with studies of air traffic control, collision avoidance, and use of satellites for aviation navigation and communications. N.E.N.

N70-34279*# University of Southern Calif., Los Angeles. Graduate School of Business Administration.
WESRAC (WESTERN RESEARCH APPLICATION CENTER) Annual Report, Period Ending 1 Feb. 1970
1 Feb. 1970 80 p
(Contract NASw-1869)
(NASA-CR-109864) Avail: CFSTI CSCL 05B

Details are presented on the operations of the center. The areas covered include the following: marketing efforts and promotional approaches; engineering and scientific applications, search activities, and cost control measures; computer operations and information systems activities; expansion of the data base; problems of educating industry to use technology; cooperative efforts with other Regional Dissemination Centers; and documentation of specific technology transfers. Increases are reported in the numbers of searches, documents provided, services performed, and new client commitments. The basic problem is still the difficulty of overcoming an apparent natural resistance of technologists to use overtly the technology developed by others. Author

N70-34323# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
USC ENGINEERING Semiannual Progress Report, 1 Apr. - 30 Sep. 1969
30 Sep. 1969 215 p refs
(Grant AF-AFOSR-1622-69)
(AD-701765; SAPR-10) Avail: CFSTI CSCL 20/12

Research in the following areas is summarized: Semiconductors; Quantum electronics and lasers; Magnetism; Defects in crystals; Metals; Plasmas; Control systems; Communication and radar systems; Switching, automata theory, and computers; Biomedical engineering; and Biomedical mathematics. TAB

N70-34360*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
THE LIFETIME EARNINGS OF ENGINEERS AND SCIENTISTS
John C. Evvard [1970] 20 p refs
(NASA-TM-X-52868; E-3853) Avail: CFSTI CSCL 05C

Results are given of a statistical analysis of salary versus experience data for engineers and scientists with emphasis on the federal employee salary system. The federal retirement benefit plan is compared with a private investment plan using a 6 1/2 percent salary deduction factor. Tables and graphs include data on lifetime earnings showing tax deductions, retirement take-home pay, and salary versus experience curves. E.C.

N70-34546# Federation of Rocky Mountain States, Inc., Denver, Colo.
SCIENCE AND TECHNOLOGY AND ITS APPLICATION TO THE PROBLEMS OF POLLUTION, TRANSPORTATION AND EMPLOYMENT. PUBLIC SCIENCE POLICY: BACKGROUND READINGS
Donald W. Galvin and Nick Jannakos 1970 144 p refs
Presented at the Western Governors Conf., Salt Lake City, 9-11 Mar. 1970 Sponsored in part by NSF
(PB-190500) Avail: CFSTI CSCL 05A

The document covers what government leaders and the science and technology community must do to set up the mechanism and lines of communication required to bring technology to bear on current public problems. It identifies potential applications of new technology to social problems in the areas of pollution, transportation, employment and future planning. It contains recommendations for federal, regional, interstate, state and local action in order to fully utilize science and technological resources, overcoming problems in federal state relations, inter-agency relations, communication, financing, and manpower. Author (USGRDR)

N70-34622# TRW Systems Group, Washington, D.C.
TRANSOP MODEL METHODOLOGY Final Report
J. R. Vadeboncoeur, T. W. Smith, and D. S. Adamson Dec. 1969 129 p
(Contract DOT-C-353-66)
(PB-190936; TRW-06818-W009-R0-00; NECTP-216) Avail: CFSTI CSCL 13B

The TRANSOP computer program was developed in order to assist in the determination of transportation equilibrium supply and demand levels for the Northeast Corridor Transporation Project. The program is built upon a proprietary optimization and simultaneous equation-solving algorithm (SLANG) developed by TW Systems Group. Applications of the TRANSOP program have included investigation of the competitive position of ground modes such as high speed rail, tracked air cushion vehicles, and tube vehicle systems. The program has also been utilized to examine similar systems in other U.S. corridors. Author (USGRDR)

N70-34644# TRW Systems Group, Washington, D.C.
HSGT MODE SERVICE ANALYSIS IN THE NORTHEAST CORRIDOR Final Report
J. R. Vadeboncoeur and T. W. Smith Dec. 1969 145 p
(Contract DOT-C-353-66)
(PB-190934; TRW-06818-W007-R0-00; NECTP-214) Avail: CFSTI CSCL 13B

The report describes the analysis of High Speed Ground Transporation service in the U. S. Northeast Corridor. In the analysis, three HSGT systems were established; a 150-mph High Speed Rail system (HSRC), and a Traced Air Cushion Vehicle system (TACV). Each of these was analyzed in competition with auto, bus, conventional air (C-TOL), short takeoff and landing (STOL), and vertical takeoff and landing (VTOL) modes. Author (USGRDR)

N70-34648# Office of High Speed Ground Transportation, Washington, D.C. Northeast Corridor Transportation Project.
NORTHEAST CORRIDOR TRANSPORTATION PROJECT REPORT
Robert A. Nelson, Paul W. Shuldiner, Myron Miller, Robert L. Winestone, Philip J. Barbato et al Apr. 1970 242 p refs
(PB-190929; NECTP-209) Avail: CFSTI CSCL 13B

The Northeast Corridor Transportation Project was charged to determine the intercity transportation facility requirements of the Northeast Corridor through 1980. A comparative analysis of the transportation alternatives as to their technical feasibility, economic costs and benefits and other impacts in the year 1975; A discussion of the actions required to implement the transportation alternatives; An examination of possible financing and management of new modes included in the alternatives; Include advantages and disadvantages of various organizational alternatives, population growth patterns and the Corridor transportation system, methodology, description of the alternative systems, and exploratory studies and sensitivity tests. Author (USGRDR)

N70-34671# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[RESEARCH IN GENERAL PHYSICS, PLASMA DYNAMICS, AND COMMUNICATION SCIENCES AND ENGINEERING] Quarterly Progress Report, Period Ending 28 Feb. 1970
H. J. Zimmermann, G. G. Harvey, and S. J. Mason 15 Apr. 1970 222 p refs
(Contract DA-28-043-AMC-02536(E))
(AD-705432; QPR-4) Avail: CFSTI CSCL 9/3

Summaries are given of research efforts in the following areas: microwave spectroscopy; Radio astronomy; Solid-state microwave electronics; Electronic instrumentation; Physical electronics and surface physics; Physical acoustics; Electrodynamics of media; Plasmas and controlled nuclear fusion; Applied plasma research; Processing and transmission of information; Detection and estimation theory; Speech communication; Linguistics; Cognitive information processing; Communications biophysics; Signal processing; Digital system design automation. TAB

N70-34677*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO INTERCENTER ICD MANAGEMENT PROCEDURE: APOLLO PROGRAM
Jan. 1969 32 p
(NASA-TM-X-64397; CM-001-001-1B) Avail: CFSTI CSCL 05A

The Apollo intercenter ICD management procedure is detailed and standard methods are presented to apply the concepts of configuration management to the identification, control, and accounting of interface control documents. Author

N70-34691# Peat, Marwick, Livingston and Co., Washington, D.C.
NORTHEAST CORRIDOR TRANSPORTATION FACTS AND STATISTICS Final Report
M. J. Rothenberg Dec. 1969 155 p refs
(Contract DOT-FR-9-0017)
(PB-190932; NECTP-212) Avail: CFSTI CSCL 13B

The material presented in the document is meant to provide basic information on the intercity transportation system and other select regional characteristics of the Northeast Corridor. Primary attention is given to the status of the existing transportation system and the magnitude and characteristics of system usage. Author (USGRDR)

N70-34702*# Informatics Tisco, Inc., College Park, Md.
NASA SCIENTIFIC AND TECHNICAL REPORTS AND PUBLICATIONS FOR 1969: A SELECTED LISTING
Washington NASA May 1970 950 p refs
(NASA-SP-7035) Avail: SOD $7.50; CFSTI CSCL 05B

A selective listing is presented of NASA reports which were printed and widely distributed and announced in Scientific and Technical Aerospace Reports (STAR) and significant articles which were announced in International Aerospace Abstracts (IAA). The arrangement of abstracts is by NASA subject categories. In each subject category, IAA references are arranged in accession number order followed by STAR references also in accession number order. The first section contains the bibliographic citations and abstracts; the second section contains five indexes (subject, personal author, corporate source, report/accession number, and accession/report number), each arranged with the "A" accessions before the "N" accessions. Author

N70-34717*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO SIMULATION AND SIMULATORS: A DEMAND BIBLIOGRAPHY
28 Feb. 1969 55 p refs
(NASA-TM-X-64398; KSC-GP-642) Avail: CFSTI CSCL 05B

A listing of periodic articles and documents on a wide variety of simulators and simulation methods was prepared in connection with the Apollo Program. S.S.

N70-34741# Peat, Marwick, Livingston and Co., Washington, D.C.
STATUS OF THE TRANSPORTATION SYSTEM AND PLANS FOR IMPROVING INTECITY TRANSPORTATION IN THE NORTHEAST CORRIDOR Final Report
Dec. 1969 189 p refs
(Contract DOT-F-9-0017)
(PB-190931; NECTP-211) Avail: CFSTI CSCL 13B

The report provides background information on the Northeast corridor, its geographic and demographic characteristics in general, and the characteristics of its travelers, in particular. Also it describes the existing corridor highway system, the rail passenger system, and the scheduled air transportation system. Author (USGRDR)

N70-34777# Joint Publications Research Service, Washington, D.C.
ROLE OR MANAGEMENT AND CONTROL SYSTEMS
Yu. A. Tikhomirov 22 Jul. 1970 16 p refs Transl. into ENGLISH from Sov. Gos. i Pravo (Moscow), no. 5, May 1970 p 62-71

(JPRS-51005) Avail: CFSTI

The nature and relationship of control systems is discussed in terms of political organizations of society. The objects of control participate in the various activities of the subjects of control and effect public opinion, the press, television, radio, and other communications media. Each controlling system developed for modern social environments facilitates the modeling of individual management levels in order to implement changes in national economy, scientific and technical progress, and economic reform. G.G.

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EUROPEAN

An extensive collection of NASA and NASA-sponsored publications is maintained by the National Lending Library for Science and Technology, Boston Spa, Yorkshire, England. By virtue of arrangements other than with NASA, the National Lending Library also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols "#" and "*", from: ESRO/ELDO Space Documentation Service, European Space Research Organization, 114, av de Neuilly, 92-Neuilly-sur-Seine, France.

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NEW NASA PUBLICATIONS

Kinetics and Thermodynamics in High-Temperature Gases (NASA SP–239)

The proceedings of a conference held at NASA Lewis Research Center, Cleveland, Ohio, March 19, 1970, to describe selected topics of Lewis' basic research in the kinetics and thermodynamics of combustion and high-temperature gases. Session titles were Chemical Equilibria, Transport Phenomena, and Chemical Kinetics. *Paperbound.* 152 pp. Available from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, for $3.00.

Advancements in Teleoperator Systems (NASA SP–5081)

The proceedings of a NASA Technology Utilization Division colloquium held at the University of Denver, February 26–27, 1969, which brought together for a sharing of ideas and experiences those working in the diversified field of remotely operated equipment. In the broad sense, a teleoperator is a device—such as a mechanical arm—which extends man's ability to accomplish work, whether in space, under the sea, in the handling of radioactive materials, or in the field of prosthetics. The latest advancements and possible applications were discussed fully. Published jointly with the Atomic Energy Commission as an AEC-NASA Technology Utilization Publication. *Paperbound.* 244 pp. Available from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, for $3.00.

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